ELABORACIÓN DE DIAGNÓSTICOS, ESTUDIOS TÉCNICOS, AJUSTES A DISEÑOS O DISEÑOS INTEGRALES, CONSTRUCCIÓN Y PUESTA EN FUNCIONAMIENTO DE LAS OBRAS DE INFRAESTRUCTURA EDUCATIVA – UBICADAS EN EL DEPARTAMENTO DE VALLE DEL CAUCA – GRUPO 02

Contrato No. PAF-JU02-G02DC-2015

RUBAU Colombia

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INFORME CÁLCULO Y ANALISIS ESTRUCTURAL INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA (BLOQUE A)

VERSION 0

BOGOTÁ
2017

CONTROL DE REVISIONES

REVISIÓN	FECHA	OBSERVACIONES
1	30/12/16	Primera Redacción

Elaborado por: Edgar Rolando Barrera Firma:	**Revisado por**: Javier José Carrillo Ortega Fecha: Enero 2017 Firma:	**Aprobado por:** Director de Interventoría Fecha: Firma:

TABLA DE CONTENIDO

LISTA DE FOTOGRAFÍAS

1 INTRODUCCIÓN

El presente documento contiene las memorias de análisis y diseño estructural correspondiente al proyecto de la “INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMAULADA” ubicado en el municipio de JAMUNDÍ en el departamento de VALLE DEL CAUCA de acuerdo al contrato No. PAF-JU02-G02DC-2015 realizando el estudio de acuerdo a la Norma Colombiana de Diseño y Construcción Sismo Resistente Ley 400 de 1997 (Modificada Ley 1229 de 2008) y Decreto 926 de Marzo de 2010, Decreto 092 del 17 de Enero de 2011, Decreto 0340 del 13 de Febrero de 2012 y en el Reglamento para Concreto Estructural ACI 318S-08.

Para la evaluación de la edificación se ha seguido un proceso normativo que incluye las etapas de inspección, evaluación, pruebas y ensayos, revisión analítica, propuesta de intervención y soluciones constructivas, que tomen en cuenta los aspectos de resistencia, ductilidad, comportamiento y estabilidad de la estructura.

2 DESCRIPCIÓN DEL TRABAJO DE OFICINA

De acuerdo a los planos arquitectónicos y visitas realizadas en campo se procedió al desarrollo del estudio y análisis estructural con la ayuda de diferentes programas tales como ETABS v9.7.4, el cual tiene en cuenta los efectos de segundo orden. Por otro lado se siguieron las recomendaciones descrita en el respectivo estudio de suelos

3 DESCRIPCIÓN DE LOS CRITERIOS BÁSICOS DE DISEÑO

El proyecto se soluciona mediante el diseño de una estructura aporticada, utilizando para el entrepiso del nivel N:-0.05 m placa maciza de espesor e= 0.10 m y en N:+3.45 m placa maciza en dos direcciones de espesor e=0.15 m para soportar el peso del tanque. La cubierta liviana se compone de perfiles y correas en el nivel N:+3.45 m. Se manejan luces entre 5.00 m y 7.00 m en los dos sentidos de la estructura.

4 NORMAS Y CÓDIGOS A LOS CUALES SE CIÑEN LOS DISEÑOS

El diseño de todas las estructuras se realizó basado en la Norma Colombiana de Diseño y Construcción Sismo Resistente Ley 400 de 1997 (Modificada Ley 1229 de 2008) y Decreto 926 de Marzo de 2010, Decreto 092 del 17 de Enero de 2011, Decreto 0340 del 13 de Febrero de 2012 y en el Reglamento para Concreto Estructural ACI 318S-08.

5 DESCRIPCIÓN DE LA METODOLOGÍA DE DISEÑO EMPLEADA.

El proyecto se soluciona mediante el diseño de una estructura aporticada, utilizando para el entrepiso del nivel N:-0.05 m placa maciza de espesor e= 0.10 m y en N:+3.45 m placa maciza en dos direcciones de espesor e=0.15 m para soportar el peso del tanque. La cubierta liviana se compone de perfiles y correas en el nivel N:+3.45 m. Se manejan luces entre 5.00 m y 7.00 m en los dos sentidos de la estructura.

Las cargas horizontales fueron distribuidas entre los diferentes pórticos en proporción a su rigidez y teniendo en cuenta los efectos de torsión.

El dimensionamiento dado a todos los elementos que intervienen en las estructuras satisfacen los requerimientos de solicitación ocasionados por las derivas presentes. Las cargas vivas de diseño son: **5.00 kN/ m²** para tanques y **0.35 kN/ m²** para cubiertas.

Para la cimentación se siguieron las recomendaciones descritas en el respectivo estudio de suelos, que recomienda apoyar la estructura a **-1.50 m** del nivel de la placa aérea de cimentación, apoyando las zapatas a **-1.50 m**, según lo indicado en los planos estructurales. La capacidad portante de seguridad admisible del suelo es **0.12 MPa** y el tipo de suelo es **E**.

6 DESCRIPCIÓN Y ANÁLISIS DE LAS CONDICIONES EXISTENTES

El sitio donde se procederá a la construcción de la estructura se encuentra ubicado una edificación existente, como se evidenciara en las fotos mostradas a continuación.

1Fotografía Estructura existente

Fuente: Propia

2Fotografía Estructura existente

Fuente: Propia

3 Fotografía Estructura existente

Fuente: Propia

4 Fotografía Estructura existente

Fuente: Propia

MEMORIAL DE RESPONSABILIDAD

JAMUNDÌ, Agosto de 2017.

Señores

PLANEACION MUNICIPAL
La Ciudad

Yo, **EDGAR ROLANDO BARRERA,** ingeniero civil con Matrícula Profesional Nº **15202-102710** de **BOYACÁ,** debidamente registrado en el consejo profesional de Ingeniería y Arquitectura de Boyacá, presento los cálculos y diseños estructurales elaborados de acuerdo a los requerimientos de la **NORMA COLOMBIANA DE DISEÑO Y CONSTRUCCIÓN SISMO RESISTENTE LEY 400 DE 1997 (MODIFICADA LEY 1229 DE 2008) Y DECRETO 926 DE MARZO DE 2010**, para el proyecto **JORNADA ÚNICA DEL MINISTERIO DE EDUCACIÓN- MODULO 2. INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMAULADA**, declaro que asumo la responsabilidad por los perjuicios que causa de ellos puedan deducirse, exonerando a la PLANEACION MUNICIPAL de cualquier responsabilidad.

Acepto y reconozco que la revisión efectuada por PLANEACION URBANA no constituye una aprobación al Diseño Estructural, sino una verificación del cumplimiento de la **NORMA COLOMBIANA DE DISEÑO Y CONSTRUCCIÓN SISMO RESISTENTE**.

Atentamente,

____

EDGAR ROLANDO BARRERA

ING. ESTRUCTURAL

T.P. 15202-102710 BYC


REPUBLICA DE COLOMBIA
CONSEJO PROFESIONAL NACIONAL DE INGENIERIA
Y SUS PROFESIONES AUXILIARES
INGENIERO CIVIL
BARRERA SALINAS
EDGAR ROLANDO
UNIVERSIDAD PEDAGOGICA Y
TECNOLOGICA DE COLOMBIA
PRESIDENTE DEL CONSEJO

7 MEMORIA DE CÁLCULO

7.1 AVALUO DE CARGAS

7.1.1 CUBIERTA LIVIANA

Teja termo-acústica			0,10 kN/m²
Estructura metálica de soporte			0,10 kN/m²
Acabados e iluminacion			0,10 kN/m²
		CM	0,30 kN/m²
	Tabla 4.2.1-2 de NSR-10 (Caso F)	CV	0,35 kN/m²
		CR	0,65 kN/m²
Muros culata	0.5x0.15x13		0,98 kN/m

CU = 1.2x0.3+1.6x0.35 = 0,9 kN/m²

Espesor de placa equivalente:

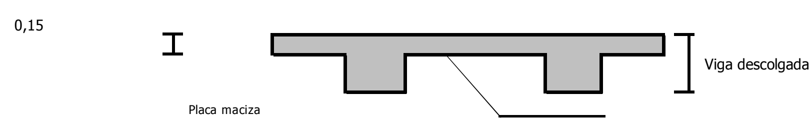
e=CM/24 0,013 m

Pendiente de Cubierta ► α (º) = 17,000

Equivale a 30.6% B.4.8.3 de NSR-10 (Carga de granizo) CV

Según la tabla B.4.2.1-2 - En cubiertas inclinadas con menos de 15° de pendiente en estructura metálica o de madera la carga viva asumida puede ser 1 kN/m^2.
Según B.4.8.3.1 - Las cargas de granizo deben tenerse en cuenta en las regiones del país con más de 2.000 metros de altura sobre el nivel del mar o en lugares de menor altura donde la autoridad municipal o distrital así lo exija.
Según B.4.8.3.2 - Para cubiertas con inclinación mayor a 15% el valor de la carga viva para granizo puede reducirse a 0.5 kN/m^2.

7.1.2 PLACA MACIZA - TANQUES



Placa maciza e=0.15m	0.15x24	3,60 kN/m²
Acabados	22x0.05	1,10 kN/m²
CM		4,70 kN/m²
Tabla 4.2.1-2 (Caso A) CV		5,00 kN/m²
CR		9,70 kN/m²
Muros antepecho	1.43x0.15x13	2,79 kN/m

CU = 1.2x4.7+1.6x5 = 13,6 kN/m²

Espesor de placa equivalente:

e=CM/24 0,196 m

7.1.2 AVALÚO DE CARGAS DE VIENTO ANÁLISIS SIMPLIFICADO (sprfv)

Para que le análisis se pueda realizar mediante el método de diseño simplificado se requiere que se cumpla con lo establecido por la NSR-10 titulo B.6.4.1.1. y B.6.4.1.2.

a - El edificio sea de diafragma simple como se define en la sección B.6.2. b - El edificio sea bajo de acuerdo con lo establecido con la sección B.6.2.
c - El edificio sea cerrado como se define en la sección B.6.2. y cumpla las provisiones de zonas propensas a huracanes de acuerdo con la sección B.6.5.9.3.
d - El edificio sea de forma regular como se define en la sección B.6.2.
e - El edificio no sea clasificado como flexible como se define en la sección B.6.2.
f - Las características de respuesta del edificio sean tales que el mismo no esté sujeto a las cargas por viento a travéz de él, a generación de vórtices, a inestabilidad por golpeteo o aleteo, y no esté ubicado en un sitio en el que se puedan presentar efectos de canalización
o sacudimiento por la estela de obstrucciones en barlovento, que obliguen a concideraciones especiales.
g - El edificio tenga una sección transversal aproximadamente simétrica en cada dirección y tenga una cubierta plana o cubierta a dos o cuatro aguas con ángulo de inclinación Ø ≤ ϰϱ°
h - El edificio esta eximido de los casos de carga torsional indicados en la nota 5 de la figura B.6.5.7. o estos casos no conctrolan el diseño de ninguno de los elementos del SPRFV del edificio.

De los anteriores parametros se observa que la edificación cumple con lo estipulado, por lo

tanto: Tipo de análisis permitido: ANÁLISIS SIMPLIFICADO

Entonces:

$$Ps = \lambda KztIPs_{10}$$

Donde:

λ=	Factor de ajuste por altura y exposición, figura B.6.4.2.
K_{zt}=	Factor topográfico como se define en la sección B.6.5.7. evaluado a la altura promedio de la cubierta,
h, B.6.5.1. I=	Factor de importancia como se define en la sección B.6.5.5.
P_{s10}=	Presión de viento de diseño simplificado para la categoria de exposición B, con h=10 m de la figura B.6.4.2.

	CIUDAD	ZONA	VELOCIDAD DEL VIENTO
Zona de amenza eólica=	JAMUNDÍ	3	100 Km/h

Luego:

λ=	1,0
K_{zt}=	1,0
I=	1,0
P_{s10}=	0,13

Según B.6.4.2.1.1. Presiones mínimas: Los efectos de carga de las presiones de viento de diseño de la sección B.6.4.2.1. no serán menores que el caso de carga mínima de la sección B.6.1.3.1. suponiendo presiones Ps, de +0.40 kN/m^2 para las zonas de A, B, C y D y de
0.00 kN/m^2 paras las zonas E, F, G y H.

Por lo tanto la carga de viento a emplear es: 0,40 kN/m^2

7.2 ANALISIS SISMICO

7.2.1 ANÁLISIS SÍSMICO (ESPECTRO DE DISEÑO NSR-10)

ZONA DE AMENAZA SÍSMICA
ALTA

EFECTOS LOCALES

Perfil de Suelo	E
Coeficiente Aa	0,25
Coeficiente Av	0,25

COEFICIENTE DE IMPORTANCIA

Grupo de Uso	III
Coeficiente de importancia I	1,25

PERIODO FUNDAMENTAL DE LA EDIFICACIÓN

$T_a = C_t h^{\alpha}$		
C_t =	0,047	
h =	3,50	m
α =	0,90	
T_a=	0,15	Seg

VARIACIÓN COEFICIENTE DE CAPACIDAD DE DISIPACIÓN DE ENERGÍA

Ro: Coeficiente de capacidad de disipación de energía básico
R: Coeficiente de capacidad de disipación de energía, para ser empleado en el diseño.
ϕ_a: Coeficiente de reducción de R causado por irregularidades en altura de la edificación
ϕ_p: Coeficiente de reducción de R causado por irregularidades en planta de la edificación
ϕ_r: Coeficiente de reducción de R causado por ausencia de redundancia en el sistema estructural de resistencia sísmica

Ro	7,00
ϕ_a	1,00
ϕ_p	1,00
ϕ_r	1,00
ϕ	1,00
R	7,00

TIPO	DESCRIPCIÓN	VALOR
	N.A	ϕ_P: 1.00
	N.A	ϕ_a: 1.00
	AUSENCIA DE REDUNDANCIA	ϕ_r: 1.00
	UNIONES SOLDADAS	ϕ: 1.00

ESPECTRO DE DISEÑO (AMORTIGUAMIENTO ξ=5% DEL CRÍTICO)

Fa: Factor de ampliación de la aceleración.
Fv: Factor de ampliación de la aceleración en el rango de velocidades constantes.
Sa: Valor del espectro de aceleraciones de diseño para un periodo de vibración dado. Aa: Coeficiente que representa la aceleración horizontal pico efectiva para diseño.
Av: Coeficiente que representa la velocidad horizontal pico efectiva para diseño. T: Periodo de vibración del sistema elástico, en segundos.
T_C: Periodo de vibración, en segundos, correspondiente a la transición entre la zona de aceleración constante del espectro de diseño, para periodos cortos, y la parte descendiente del mismo. T_L: Periodo de vibración, en segundos, correspondiente al inicio de la zona de desplazamiento aproximadamente constante del espectro de diseño para periodos largos.

ZONA DE AMENAZA ALTA		
T_o:	0,21	Seg
T_C:	0,99	Seg
T_L:	7,20	Seg
Aa:	0,25	
Av:	0,25	
Fa:	1,45	
Fv:	3,00	

T	Sa	Sa/$R_{adoptado}$
(Seg)	(%g)	(%g)
0,00	1,133	0,162
0,05	1,133	0,162
0,10	1,133	0,162
0,16	1,133	0,162
0,21	1,133	0,162
0,40	1,133	0,162
0,60	1,133	0,162
0,80	1,133	0,162
0,99	1,133	0,162
1,34	0,841	0,120
1,68	0,669	0,096
2,03	0,555	0,079
2,37	0,474	0,068
2,72	0,414	0,059
3,06	0,367	0,052
3,41	0,330	0,047
3,75	0,300	0,043
4,10	0,275	0,039
4,44	0,253	0,036
4,79	0,235	0,034
5,13	0,219	0,031
5,48	0,205	0,029
5,82	0,193	0,028
6,17	0,182	0,026
6,51	0,173	0,025
6,86	0,164	0,023
7,20	0,156	0,022
8,20	0,120	0,017
9,20	0,096	0,014

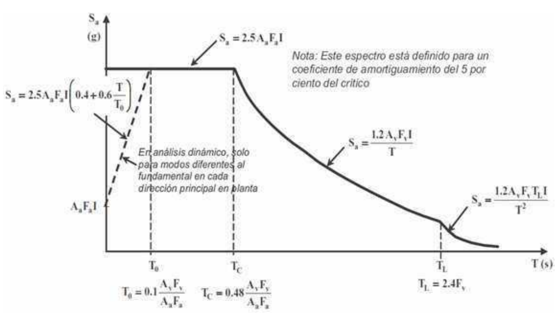
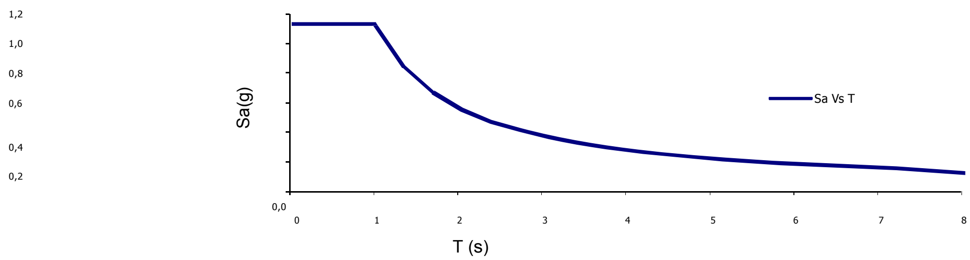
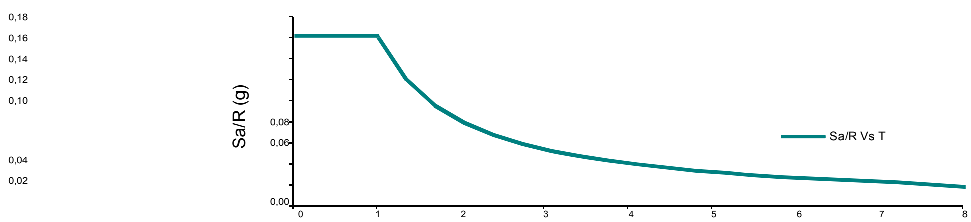


Figura A.2.6-1 — Espectro Elástico de Aceleraciones de Diseño como fracción de g

Espectro Elástico de Diseño



Espectro Elástico de Diseño/R_{adop}



Sistema de resistencia Sísmica: Pórticos resistentes a momentos con Capacidad Especial de Disipación de Energía (DES).

Nota: El sistema de pórtico es un sistema estructural compuesto por un pórtico espacial, resistente a momentos, esencialmente completo, sin diagonales, que resiste todas las cargas verticales y las fuerzas horizontales.

MODELO MATEMÁTICO

Modelo Tridimensional con Diafragma Rígido: En este modelo los entrepisos se consideran diafragmas infinitamente rigidos en su propio plano. La masa de cada diafragma se considera concentrada en su centro de masa. Los efectos torsionales accidentales son incluidos
Haciendo ajustes en la localización de los centros de masa de los diafragmas.
Los efectos direccionales son tomados en cuenta a través de las componentes de los desplazamientos de los grados de libertad horizontales ortogonales del diafragma.

7.2.2 ANÁLISIS SÍSMICO (ESPECTRO DE UMBRAL DE DAÑO NSR-10)

ZONA DE AMENAZA SÍSMICA
ALTA

EFECTOS LOCALES

Perfil de Suelo	E
Coeficiente Ad	0,09
Coeficiente Fv	3,50

COEFICIENTE DE IMPORTANCIA

Grupo de Uso	III
Coeficiente de importancia I	1,25
Coeficiente de Sitio Ŝ:	4,38

ESPECTRO DE UMBRAL DE DAÑO (AMORTIGUAMIENTO ξ=2% DEL CRÍTICO)

Sad: Valor del espectro de aceleraciones del umbral de daño para un periodo de vibración dado. Ad: Máxima aceleración pico efectiva para el umbral de daño.

T: Periodo de vibración del sistema elástico, en segundos.

T_{Cd}: Periodo de vibración, en segundos, correspondiente a la transición entre la zona de aceleración constante del espectro sísmico del umbral de daño, para periodos cortos, y la parte descendiente del mismo.

T_{Ld}: Periodo de vibración, en segundos, correspondiente a la transición entre la zona de desplazamiento constante del espectro sísmico del umbral de daño, para periodos largos.

Ad: 0,09

T_{Cd}: 2,19 Seg

T_{Ld}: 10,5 Seg

T (Seg)	Sad (%g)
0,00	0,090
0,05	0,126
0,10	0,162
0,15	0,198
0,20	0,234
0,25	0,270
0,49	0,270
0,73	0,270
0,98	0,270
1,22	0,270
1,46	0,270
1,70	0,270
1,95	0,270

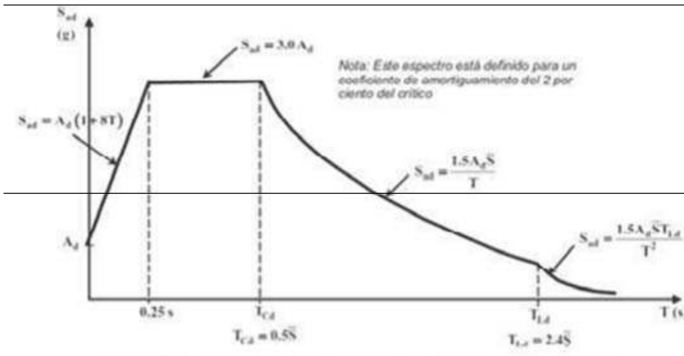
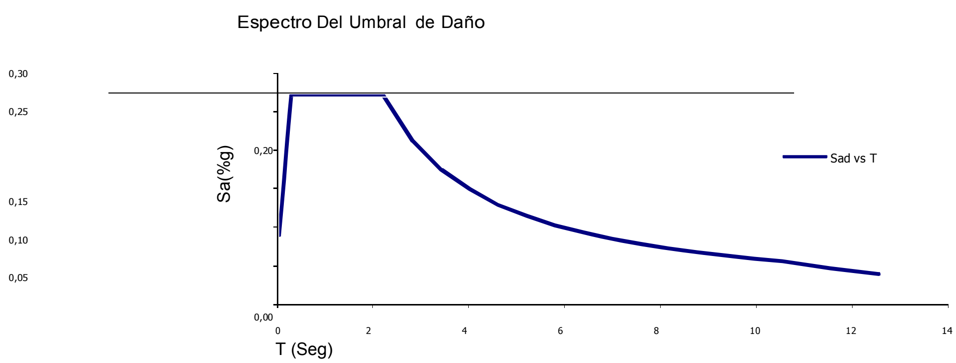


Figura A.12.3-1 — Espectro de aceleraciones horizontales elástico del umbral de daño

2,19	0,270
2,78	0,212
3,38	0,175
3,97	0,149
4,56	0,129
5,16	0,115
5,75	0,103
6,34	0,093
6,94	0,085
7,53	0,078
8,13	0,073
8,72	0,068
9,31	0,063
9,91	0,060
10,50	0,056
11,50	0,047
12,50	0,040



Sistema de resistencia Sísmica: Pórticos resistentes a momentos con Capacidad Especial de Disipación de Energía (DES).

Nota: El sistema de pórtico es un sistema estructural compuesto por un pórtico espacial, resistente a momentos, esencialmente completo, sin diagonales, que resiste todas las cargas verticales y las fuerzas horizontales.

MODELO MATEMÁTICO

Modelo Tridimensional con Diafragma Rígido: En este modelo los entrepisos se consideran diafragmas infinitamente rigidos en su propio plano. La masa de cada diafragma se considera concentrada en su centro de masa. Los efectos torsionales accidentales son incluidos
haciendo ajustes en la localización de los centros de masa de los diafragmas.
Los efectos direccionales son tomados en cuenta a través de las componentes de los desplazamientos de los grados de libertad horizontales ortogonales del diafragma.

7.2.4 CALCULO DEL CORTANTE BASAL DE LA ESTRUCTURA (ESPECTRO DE UMBRAL DE DAÑO NSR-10)

CALCULO DEL CORTANTE BASAL DE LA ESTRUCTURA

$H_{edificio}$= Tipo de Perfil:	3,50	m	
Ad =	E		
	0,09		
Fv =	0,40		
C_t =	0,047		
α =	0,90		
T_a =	0,15	Seg	
C_u =	1,20		
$C_u T_a$ =	0,17	Seg	
$T_{modelación\ estructural}$ =	0,15	Seg	
ΔT =	3,36	%	Ok!
$T_{adoptado}$ =	0,15	Seg	
S_a =	0,270		S_a obtenido del espectro de diseño
g =	9,81	m/s^2	
M =	80,37	Ton	Masa obtenida del modelo
V_s =	212,88	kN	

MODELO INICIAL
Response Espectrum Base Reactions

PORCENTAJE PARA REVISIÓN DE CORTANTE BASAL DE ACUERDO A A.5.4.5 NSR-10: 100,0 %

	F1	F2	Total	Factor		g corregido
$V_{s(x)}$=	181,94	0	181,94	1,170	11,478	Se aplica en SISMO X
$V_{s(y)}$=	0	138,15	138,15	1,541	15,116	Se aplica en SISMO Y

MODELO CORREGIDO
Response Espectrum Base Reactions

	F1	F2	Total	100% Vs
$V_{s(x)}$=	212,88	0	212,88	212,9
$V_{s(y)}$=	0	212,87	212,87	212,9

7.2.3 CÁLCULO DE DERIVAS MÁXIMAS

ALTURA DE N+5.93	0,59	m
ALTURA DE N+5.34	1,39	m
ALTURA DE N+3.95	0,50	m
ALTURA DE N+3.45	3,50	m
ALTURA DE BASE	0,00	m
ALTURA DE	0,00	m

Deriva Máxima Permitida

1,00 %

0,104275929

Nivel	Punto	COMBINACIÓN DE CARGA	DESPLAZAMIENTOS FUERZA SÍSMICA Desplazamiento X	Desplazamiento Y	Deriva Δ m	Deriva Δ %	Observación
N+3.45	1	COMDER1 MAX	0,006	0,0015	0,00618	0,18	OK
N+3.45	1	COMDER1 MIN	-0,006	-0,0015	0,00618	0,18	OK
N+3.45	1	COMDER2 MAX	0,0026	0,0023	0,00347	0,10	OK
N+3.45	1	COMDER2 MIN	-0,0026	-0,0023	0,00347	0,10	OK
BASE	1	COMDER1 MAX	0	0	--	--	--
BASE	1	COMDER1 MIN	0	0	--	--	--
BASE	1	COMDER2 MAX	0	0	--	--	--
BASE	1	COMDER2 MIN	0	0	--	--	--
N+3.45	2	COMDER1 MAX	0,006	0,001	0,00608	0,17	OK
N+3.45	2	COMDER1 MIN	-0,006	-0,001	0,00608	0,17	OK
N+3.45	2	COMDER2 MAX	0,0026	0,0022	0,00341	0,10	OK
N+3.45	2	COMDER2 MIN	-0,0026	-0,0022	0,00341	0,10	OK
BASE	2	COMDER1 MAX	0	0	--	--	--
BASE	2	COMDER1 MIN	0	0	--	--	--
BASE	2	COMDER2 MAX	0	0	--	--	--
BASE	2	COMDER2 MIN	0	0	--	--	--
N+3.45	3	COMDER1 MAX	0,006	0,0018	0,00626	0,18	OK
N+3.45	3	COMDER1 MIN	-0,006	-0,0018	0,00626	0,18	OK
N+3.45	3	COMDER2 MAX	0,0026	0,0034	0,00428	0,12	OK
N+3.45	3	COMDER2 MIN	-0,0026	-0,0034	0,00428	0,12	OK
BASE	3	COMDER1 MAX	0	0	--	--	--
BASE	3	COMDER1 MIN	0	0	--	--	--
BASE	3	COMDER2 MAX	0	0	--	--	--
BASE	3	COMDER2 MIN	0	0	--	--	--
N+3.45	4	COMDER1 MAX	0,006	0,003	0,00671	0,19	OK
N+3.45	4	COMDER1 MIN	-0,006	-0,003	0,00671	0,19	OK
N+3.45	4	COMDER2 MAX	0,0026	0,005	0,00564	0,16	OK
N+3.45	4	COMDER2 MIN	-0,0026	-0,005	0,00564	0,16	OK
BASE	4	COMDER1 MAX	0	0	--	--	--
BASE	4	COMDER1 MIN	0	0	--	--	--
BASE	4	COMDER2 MAX	0	0	--	--	--
BASE	4	COMDER2 MIN	0	0	--	--	--
N+3.45	7	COMDER1 MAX	0,0056	0,0015	0,00580	0,17	OK
N+3.45	7	COMDER1 MIN	-0,0056	-0,0015	0,00580	0,17	OK
N+3.45	7	COMDER2 MAX	0,0031	0,0023	0,00386	0,11	OK
N+3.45	7	COMDER2 MIN	-0,0031	-0,0023	0,00386	0,11	OK
BASE	7	COMDER1 MAX	0	0	--	--	--
BASE	7	COMDER1 MIN	0	0	--	--	--
BASE	7	COMDER2 MAX	0	0	--	--	--
BASE	7	COMDER2 MIN	0	0	--	--	--
N+3.45	8	COMDER1 MAX	0,0056	0,001	0,00569	0,16	OK
N+3.45	8	COMDER1 MIN	-0,0056	-0,001	0,00569	0,16	OK
N+3.45	8	COMDER2 MAX	0,0031	0,0022	0,00380	0,11	OK
N+3.45	8	COMDER2 MIN	-0,0031	-0,0022	0,00380	0,11	OK
BASE	8	COMDER1 MAX	0	0	--	--	--
BASE	8	COMDER1 MIN	0	0	--	--	--
BASE	8	COMDER2 MAX	0	0	--	--	--
BASE	8	COMDER2 MIN	0	0	--	--	--
N+3.45	9	COMDER1 MAX	0,0056	0,0018	0,00588	0,17	OK
N+3.45	9	COMDER1 MIN	-0,0056	-0,0018	0,00588	0,17	OK
N+3.45	9	COMDER2 MAX	0,0031	0,0034	0,00460	0,13	OK
N+3.45	9	COMDER2 MIN	-0,0031	-0,0034	0,00460	0,13	OK
BASE	9	COMDER1 MAX	0	0	--	--	--
BASE	9	COMDER1 MIN	0	0	--	--	--
BASE	9	COMDER2 MAX	0	0	--	--	--
BASE	9	COMDER2 MIN	0	0	--	--	--
N+3.45	10	COMDER1 MAX	0,0056	0,003	0,00635	0,18	OK
N+3.45	10	COMDER1 MIN	-0,0056	-0,003	0,00635	0,18	OK
N+3.45	10	COMDER2 MAX	0,0031	0,005	0,00588	0,17	OK
N+3.45	10	COMDER2 MIN	-0,0031	-0,005	0,00588	0,17	OK
BASE	10	COMDER1 MAX	0	0	--	--	--
BASE	10	COMDER1 MIN	0	0	--	--	--
BASE	10	COMDER2 MAX	0	0	--	--	--
BASE	10	COMDER2 MIN	0	0	--	--	--
N+3.45	13	COMDER1 MAX	0,0056	0,0015	0,00580	0,17	OK
N+3.45	13	COMDER1 MIN	-0,0056	-0,0015	0,00580	0,17	OK
N+3.45	13	COMDER2 MAX	0,0048	0,0023	0,00532	0,15	OK
N+3.45	13	COMDER2 MIN	-0,0048	-0,0023	0,00532	0,15	OK
BASE	13	COMDER1 MAX	0	0	--	--	--
BASE	13	COMDER1 MIN	0	0	--	--	--
BASE	13	COMDER2 MAX	0	0	--	--	--
BASE	13	COMDER2 MIN	0	0	--	--	--
N+3.45	14	COMDER1 MAX	0,0056	0,001	0,00569	0,16	OK
N+3.45	14	COMDER1 MIN	-0,0056	-0,001	0,00569	0,16	OK
N+3.45	14	COMDER2 MAX	0,0048	0,0022	0,00528	0,15	OK
N+3.45	14	COMDER2 MIN	-0,0048	-0,0022	0,00528	0,15	OK
BASE	14	COMDER1 MAX	0	0	--	--	--
BASE	14	COMDER1 MIN	0	0	--	--	--
BASE	14	COMDER2 MAX	0	0	--	--	--
BASE	14	COMDER2 MIN	0	0	--	--	--

ALTURA DE N+5.93	0,59	m
ALTURA DE N+5.34	1,39	m
ALTURA DE N+3.95	0,50	m
ALTURA DE N+3.45	3,50	m
ALTURA DE BASE	0,00	m
ALTURA DE	0,00	m

Deriva Máxima Permitida 1,00 %

0,104275929

Nivel	Punto	COMBINACIÓN DE CARGA	DESPLAZAMIENTOS FUERZA SÍSMICA Desplazamiento X	Desplazamiento Y	Deriva Δ m	Deriva Δ %	Observación
N+3.45	15	COMDER1 MAX	0,0056	0,0018	0,00588	0,17	OK
N+3.45	15	COMDER1 MIN	-0,0056	-0,0018	0,00588	0,17	OK
N+3.45	15	COMDER2 MAX	0,0048	0,0034	0,00588	0,17	OK
N+3.45	15	COMDER2 MIN	-0,0048	-0,0034	0,00588	0,17	OK
BASE	15	COMDER1 MAX	0	0	--	--	--
BASE	15	COMDER1 MIN	0	0	--	--	--
BASE	15	COMDER2 MAX	0	0	--	--	--
BASE	15	COMDER2 MIN	0	0	--	--	--
N+3.45	16	COMDER1 MAX	0,0056	0,003	0,00635	0,18	OK
N+3.45	16	COMDER1 MIN	-0,0056	-0,003	0,00635	0,18	OK
N+3.45	16	COMDER2 MAX	0,0048	0,005	0,00693	0,20	OK
N+3.45	16	COMDER2 MIN	-0,0048	-0,005	0,00693	0,20	OK
BASE	16	COMDER1 MAX	0	0	--	--	--
BASE	16	COMDER1 MIN	0	0	--	--	--
BASE	16	COMDER2 MAX	0	0	--	--	--
BASE	16	COMDER2 MIN	0	0	--	--	--
N+3.45	75	COMDER1 MAX	0,0067	0,0014	0,00684	0,20	OK
N+3.45	75	COMDER1 MIN	-0,0067	-0,0014	0,00684	0,20	OK
N+3.45	75	COMDER2 MAX	0,0036	0,0023	0,00427	0,12	OK
N+3.45	75	COMDER2 MIN	-0,0036	-0,0023	0,00427	0,12	OK
BASE	75	COMDER1 MAX	0	0	--	--	--
BASE	75	COMDER1 MIN	0	0	--	--	--
BASE	75	COMDER2 MAX	0	0	--	--	--
BASE	75	COMDER2 MIN	0	0	--	--	--
N+3.45	76	COMDER1 MAX	0,0067	0,001	0,00677	0,19	OK
N+3.45	76	COMDER1 MIN	-0,0067	-0,001	0,00677	0,19	OK
N+3.45	76	COMDER2 MAX	0,0036	0,0022	0,00422	0,12	OK
N+3.45	76	COMDER2 MIN	-0,0036	-0,0022	0,00422	0,12	OK
BASE	76	COMDER1 MAX	0	0	--	--	--
BASE	76	COMDER1 MIN	0	0	--	--	--
BASE	76	COMDER2 MAX	0	0	--	--	--
BASE	76	COMDER2 MIN	0	0	--	--	--
N+3.45	77	COMDER1 MAX	0,0068	0,0019	0,00706	0,20	OK
N+3.45	77	COMDER1 MIN	-0,0068	-0,0019	0,00706	0,20	OK
N+3.45	77	COMDER2 MAX	0,0036	0,0034	0,00495	0,14	OK
N+3.45	77	COMDER2 MIN	-0,0036	-0,0034	0,00495	0,14	OK
BASE	77	COMDER1 MAX	0	0	--	--	--
BASE	77	COMDER1 MIN	0	0	--	--	--
BASE	77	COMDER2 MAX	0	0	--	--	--
BASE	77	COMDER2 MIN	0	0	--	--	--
N+3.45	78	COMDER1 MAX	0,0068	0,003	0,00743	0,21	OK
N+3.45	78	COMDER1 MIN	-0,0068	-0,003	0,00743	0,21	OK
N+3.45	78	COMDER2 MAX	0,0037	0,005	0,00622	0,18	OK
N+3.45	78	COMDER2 MIN	-0,0037	-0,005	0,00622	0,18	OK
BASE	78	COMDER1 MAX	0	0	--	--	--
BASE	78	COMDER1 MIN	0	0	--	--	--
BASE	78	COMDER2 MAX	0	0	--	--	--
BASE	78	COMDER2 MIN	0	0	--	--	--

ALTURA DE N+5.93	0,59	m
ALTURA DE N+5.34	1,39	m
ALTURA DE N+3.95	0,50	m
ALTURA DE N+3.45	3,50	m
ALTURA DE BASE	0,00	m
ALTURA DE	0,00	m

Deriva Máxima Permitida 0,40 %

0,020855186

Nivel	Punto	COMBINACIÓN DE CARGA	DESPLAZAMIENTOS FUERZA SÍSMICA Desplazamiento X	Desplazamiento Y	Deriva Δ m	Deriva Δ %	Observación
N+3.45	1	COMDERUMB1 MAX	0,0012	0,0003	0,00124	0,04	OK
N+3.45	1	COMDERUMB1 MIN	-0,0012	-0,0003	0,00124	0,04	OK
N+3.45	1	COMDERUMB2 MAX	0,0005	0,0005	0,00071	0,02	OK
N+3.45	1	COMDERUMB2 MIN	-0,0005	-0,0005	0,00071	0,02	OK
BASE	1	COMDERUMB1 MAX	0	0	--	--	--
BASE	1	COMDERUMB1 MIN	0	0	--	--	--
BASE	1	COMDERUMB2 MAX	0	0	--	--	--
BASE	1	COMDERUMB2 MIN	0	0	--	--	--
N+3.45	2	COMDERUMB1 MAX	0,0012	0,0002	0,00122	0,03	OK
N+3.45	2	COMDERUMB1 MIN	-0,0012	-0,0002	0,00122	0,03	OK
N+3.45	2	COMDERUMB2 MAX	0,0005	0,0005	0,00071	0,02	OK
N+3.45	2	COMDERUMB2 MIN	-0,0005	-0,0005	0,00071	0,02	OK
BASE	2	COMDERUMB1 MAX	0	0	--	--	--
BASE	2	COMDERUMB1 MIN	0	0	--	--	--
BASE	2	COMDERUMB2 MAX	0	0	--	--	--
BASE	2	COMDERUMB2 MIN	0	0	--	--	--
N+3.45	3	COMDERUMB1 MAX	0,0012	0,0004	0,00126	0,04	OK
N+3.45	3	COMDERUMB1 MIN	-0,0012	-0,0004	0,00126	0,04	OK
N+3.45	3	COMDERUMB2 MAX	0,0005	0,0008	0,00094	0,03	OK
N+3.45	3	COMDERUMB2 MIN	-0,0005	-0,0008	0,00094	0,03	OK
BASE	3	COMDERUMB1 MAX	0	0	--	--	--
BASE	3	COMDERUMB1 MIN	0	0	--	--	--
BASE	3	COMDERUMB2 MAX	0	0	--	--	--
BASE	3	COMDERUMB2 MIN	0	0	--	--	--
N+3.45	4	COMDERUMB1 MAX	0,0012	0,0006	0,00134	0,04	OK
N+3.45	4	COMDERUMB1 MIN	-0,0012	-0,0006	0,00134	0,04	OK
N+3.45	4	COMDERUMB2 MAX	0,0005	0,0012	0,00130	0,04	OK
N+3.45	4	COMDERUMB2 MIN	-0,0005	-0,0012	0,00130	0,04	OK
BASE	4	COMDERUMB1 MAX	0	0	--	--	--
BASE	4	COMDERUMB1 MIN	0	0	--	--	--
BASE	4	COMDERUMB2 MAX	0	0	--	--	--
BASE	4	COMDERUMB2 MIN	0	0	--	--	--
N+3.45	7	COMDERUMB1 MAX	0,0011	0,0003	0,00114	0,03	OK
N+3.45	7	COMDERUMB1 MIN	-0,0011	-0,0003	0,00114	0,03	OK
N+3.45	7	COMDERUMB2 MAX	0,0007	0,0005	0,00086	0,02	OK
N+3.45	7	COMDERUMB2 MIN	-0,0007	-0,0005	0,00086	0,02	OK
BASE	7	COMDERUMB1 MAX	0	0	--	--	--
BASE	7	COMDERUMB1 MIN	0	0	--	--	--
BASE	7	COMDERUMB2 MAX	0	0	--	--	--
BASE	7	COMDERUMB2 MIN	0	0	--	--	--
N+3.45	8	COMDERUMB1 MAX	0,0011	0,0002	0,00112	0,03	OK
N+3.45	8	COMDERUMB1 MIN	-0,0011	-0,0002	0,00112	0,03	OK
N+3.45	8	COMDERUMB2 MAX	0,0007	0,0005	0,00086	0,02	OK
N+3.45	8	COMDERUMB2 MIN	-0,0007	-0,0005	0,00086	0,02	OK
BASE	8	COMDERUMB1 MAX	0	0	--	--	--
BASE	8	COMDERUMB1 MIN	0	0	--	--	--
BASE	8	COMDERUMB2 MAX	0	0	--	--	--
BASE	8	COMDERUMB2 MIN	0	0	--	--	--
N+3.45	9	COMDERUMB1 MAX	0,0011	0,0004	0,00117	0,03	OK
N+3.45	9	COMDERUMB1 MIN	-0,0011	-0,0004	0,00117	0,03	OK
N+3.45	9	COMDERUMB2 MAX	0,0007	0,0008	0,00106	0,03	OK
N+3.45	9	COMDERUMB2 MIN	-0,0007	-0,0008	0,00106	0,03	OK
BASE	9	COMDERUMB1 MAX	0	0	--	--	--
BASE	9	COMDERUMB1 MIN	0	0	--	--	--
BASE	9	COMDERUMB2 MAX	0	0	--	--	--
BASE	9	COMDERUMB2 MIN	0	0	--	--	--
N+3.45	10	COMDERUMB1 MAX	0,0011	0,0006	0,00125	0,04	OK
N+3.45	10	COMDERUMB1 MIN	-0,0011	-0,0006	0,00125	0,04	OK
N+3.45	10	COMDERUMB2 MAX	0,0007	0,0012	0,00139	0,04	OK
N+3.45	10	COMDERUMB2 MIN	-0,0007	-0,0012	0,00139	0,04	OK
BASE	10	COMDERUMB1 MAX	0	0	--	--	--
BASE	10	COMDERUMB1 MIN	0	0	--	--	--
BASE	10	COMDERUMB2 MAX	0	0	--	--	--
BASE	10	COMDERUMB2 MIN	0	0	--	--	--
N+3.45	13	COMDERUMB1 MAX	0,0012	0,0003	0,00124	0,04	OK
N+3.45	13	COMDERUMB1 MIN	-0,0012	-0,0003	0,00124	0,04	OK
N+3.45	13	COMDERUMB2 MAX	0,0011	0,0005	0,00121	0,03	OK
N+3.45	13	COMDERUMB2 MIN	-0,0011	-0,0005	0,00121	0,03	OK
BASE	13	COMDERUMB1 MAX	0	0	--	--	--
BASE	13	COMDERUMB1 MIN	0	0	--	--	--
BASE	13	COMDERUMB2 MAX	0	0	--	--	--
BASE	13	COMDERUMB2 MIN	0	0	--	--	--
N+3.45	14	COMDERUMB1 MAX	0,0012	0,0002	0,00122	0,03	OK
N+3.45	14	COMDERUMB1 MIN	-0,0012	-0,0002	0,00122	0,03	OK
N+3.45	14	COMDERUMB2 MAX	0,0011	0,0005	0,00121	0,03	OK
N+3.45	14	COMDERUMB2 MIN	-0,0011	-0,0005	0,00121	0,03	OK
BASE	14	COMDERUMB1 MAX	0	0	--	--	--
BASE	14	COMDERUMB1 MIN	0	0	--	--	--
BASE	14	COMDERUMB2 MAX	0	0	--	--	--
BASE	14	COMDERUMB2 MIN	0	0	--	--	--
N+3.45	15	COMDERUMB1 MAX	0,0012	0,0004	0,00126	0,04	OK

ALTURA DE N+5.93	0,59	m
ALTURA DE N+5.34	1,39	m
ALTURA DE N+3.95	0,50	m
ALTURA DE N+3.45	3,50	m
ALTURA DE BASE	0,00	m
ALTURA DE	0,00	m

Deriva Máxima Permitida 0,40 %

0,020855186

Nivel	Punto	COMBINACIÓN DE CARGA	DESPLAZAMIENTOS FUERZA SÍSMICA Desplazamiento X	Desplazamiento Y	Deriva ∆ m	Deriva ∆ %	Observación
N+3.45	15	COMDERUMB1 MIN	-0,0012	-0,0004	0,00126	0,04	OK
N+3.45	15	COMDERUMB2 MAX	0,0011	0,0008	0,00136	0,04	OK
N+3.45	15	COMDERUMB2 MIN	-0,0011	-0,0008	0,00136	0,04	OK
BASE	15	COMDERUMB1 MAX	0	0	--	--	--
BASE	15	COMDERUMB1 MIN	0	0	--	--	--
BASE	15	COMDERUMB2 MAX	0	0	--	--	--
BASE	15	COMDERUMB2 MIN	0	0	--	--	--
N+3.45	16	COMDERUMB1 MAX	0,0012	0,0006	0,00134	0,04	OK
N+3.45	16	COMDERUMB1 MIN	-0,0012	-0,0006	0,00134	0,04	OK
N+3.45	16	COMDERUMB2 MAX	0,0011	0,0012	0,00163	0,05	OK
N+3.45	16	COMDERUMB2 MIN	-0,0011	-0,0012	0,00163	0,05	OK
BASE	16	COMDERUMB1 MAX	0	0	--	--	--
BASE	16	COMDERUMB1 MIN	0	0	--	--	--
BASE	16	COMDERUMB2 MAX	0	0	--	--	--
BASE	16	COMDERUMB2 MIN	0	0	--	--	--
N+3.45	75	COMDERUMB1 MAX	0,0013	0,0003	0,00133	0,04	OK
N+3.45	75	COMDERUMB1 MIN	-0,0013	-0,0003	0,00133	0,04	OK
N+3.45	75	COMDERUMB2 MAX	0,0008	0,0005	0,00094	0,03	OK
N+3.45	75	COMDERUMB2 MIN	-0,0008	-0,0005	0,00094	0,03	OK
BASE	75	COMDERUMB1 MAX	0	0	--	--	--
BASE	75	COMDERUMB1 MIN	0	0	--	--	--
BASE	75	COMDERUMB2 MAX	0	0	--	--	--
BASE	75	COMDERUMB2 MIN	0	0	--	--	--
N+3.45	76	COMDERUMB1 MAX	0,0013	0,0002	0,00132	0,04	OK
N+3.45	76	COMDERUMB1 MIN	-0,0013	-0,0002	0,00132	0,04	OK
N+3.45	76	COMDERUMB2 MAX	0,0008	0,0005	0,00094	0,03	OK
N+3.45	76	COMDERUMB2 MIN	-0,0008	-0,0005	0,00094	0,03	OK
BASE	76	COMDERUMB1 MAX	0	0	--	--	--
BASE	76	COMDERUMB1 MIN	0	0	--	--	--
BASE	76	COMDERUMB2 MAX	0	0	--	--	--
BASE	76	COMDERUMB2 MIN	0	0	--	--	--
N+3.45	77	COMDERUMB1 MAX	0,0014	0,0004	0,00146	0,04	OK
N+3.45	77	COMDERUMB1 MIN	-0,0014	-0,0004	0,00146	0,04	OK
N+3.45	77	COMDERUMB2 MAX	0,0008	0,0008	0,00113	0,03	OK
N+3.45	77	COMDERUMB2 MIN	-0,0008	-0,0008	0,00113	0,03	OK
BASE	77	COMDERUMB1 MAX	0	0	--	--	--
BASE	77	COMDERUMB1 MIN	0	0	--	--	--
BASE	77	COMDERUMB2 MAX	0	0	--	--	--
BASE	77	COMDERUMB2 MIN	0	0	--	--	--
N+3.45	78	COMDERUMB1 MAX	0,0014	0,0006	0,00152	0,04	OK
N+3.45	78	COMDERUMB1 MIN	-0,0014	-0,0006	0,00152	0,04	OK
N+3.45	78	COMDERUMB2 MAX	0,0008	0,0012	0,00144	0,04	OK
N+3.45	78	COMDERUMB2 MIN	-0,0008	-0,0012	0,00144	0,04	OK
BASE	78	COMDERUMB1 MAX	0	0	--	--	--
BASE	78	COMDERUMB1 MIN	0	0	--	--	--
BASE	78	COMDERUMB2 MAX	0	0	--	--	--
BASE	78	COMDERUMB2 MIN	0	0	--	--	--

7.2.4 VERIFICACION DE IRREGULARIDAD TORSIONAL

							Irregularidad Torsional	Irregularidad Torsional Extrema		
Story	Point	Load	UX	UY	UZ	Δ_1	$1.2*(\Delta_1+\Delta_2)/2$	$1.4*(\Delta_1+\Delta_2)/2$	I.T.Extrema≥Δ1 >I.T.?	Δ1>I.T.Extrema?
			m	m	m	m				
N+3.45	78	COMDER1 MAX	0,0068	0,003	0	0,0074	0,0085	0,0099	NO	NO
N+3.45	78	COMDER1 MIN	-0,0068	-0,003	0	0,0074	0,0085	0,0099	NO	NO
N+3.45	78	COMDER2 MAX	0,0037	0,005	0	0,0062	0,0071	0,0083	NO	NO
N+3.45	78	COMDER2 MIN	-0,0037	-0,005	0	0,0062	0,0071	0,0083	NO	NO
BASE	78	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	78	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	78	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	78	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

							Irregularidad Torsional	Irregularidad Torsional Extrema		
Story	Point	Load	UX	UY	UZ	Δ_1	$1.2*(\Delta_1+\Delta_2)/2$	$1.4*(\Delta_1+\Delta_2)/2$	I.T.Ex rema≥Δ1 >I.T.?	Δ1>I.T.Extrema?
N+3.45	4	COMDER1 MAX	0,006	0,003	0	0,0067	0,0078	0,0091	NO	NO
N+3.45	4	COMDER1 MIN	-0,006	-0,003	0	0,0067	0,0078	0,0091	NO	NO
N+3.45	4	COMDER2 MAX	0,0026	0,005	0	0,0056	0,0069	0,0081	NO	NO
N+3.45	4	COMDER2 MIN	-0,0026	-0,005	0	0,0056	0,0069	0,0081	NO	NO
BASE	4	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	4	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	4	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	4	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

							Irregularidad Torsional	Irregularidad Torsional Extrema		
Story	Point	Load	UX	UY	UZ	Δ_1	$1.2*(\Delta_1+\Delta_2)/2$	$1.4*(\Delta_1+\Delta_2)/2$	I.T.Ex rema≥Δ1 >I.T.?	Δ1>I.T.Extrema?
			m	m	m	m				
N+3.45	10	COMDER1 MAX	0,0056	0,003	0	0,0064	0,0073	0,0086	NO	NO
N+3.45	10	COMDER1 MIN	-0,0056	-0,003	0	0,0064	0,0073	0,0086	NO	NO
N+3.45	10	COMDER2 MAX	0,0031	0,005	0	0,0059	0,0063	0,0073	NO	NO
N+3.45	10	COMDER2 MIN	-0,0031	-0,005	0	0,0059	0,0063	0,0073	NO	NO
BASE	10	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	10	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	10	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	10	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

Story	Point	Load	UX	UY	UZ	Δ_1	Irregularidad Torsional $1.2*(\Delta_1+\Delta_2)/2$	Irregularidad Torsional Extrema $1.4*(\Delta_1+\Delta_2)/2$	I.T.Extrema≥Δ1 >I.T.?	Δ1>I.T.Extrema?
			m	m	m	m				
N+3.45	9	COMDER1 MAX	0,0056	0,0018	0	0,0059	0,0069	0,0081	NO	NO
N+3.45	9	COMDER1 MIN	-0,0056	-0,0018	0	0,0059	0,0069	0,0081	NO	NO
N+3.45	9	COMDER2 MAX	0,0031	0,0034	0	0,0046	0,0050	0,0059	NO	NO
N+3.45	9	COMDER2 MIN	-0,0031	-0,0034	0	0,0046	0,0050	0,0059	NO	NO
BASE	9	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	9	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	9	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	9	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

Story	Point	Load	UX	UY	UZ	Δ_1	Irregularidad Torsional $1.2*(\Delta_1+\Delta_2)/2$	Irregularidad Torsional Extrema $1.4*(\Delta_1+\Delta_2)/2$	I.T.Extrema≥Δ1 >I.T.?	Δ1>I.T.Extrema?
			m	m	m	m				
N+3.45	8	COMDER1 MAX	0,0056	0,001	0	0,0057	0,0069	0,0080	NO	NO
N+3.45	8	COMDER1 MIN	-0,0056	-0,001	0	0,0057	0,0069	0,0080	NO	NO
N+3.45	8	COMDER2 MAX	0,0031	0,0022	0	0,0038	0,0046	0,0054	NO	NO
N+3.45	8	COMDER2 MIN	-0,0031	-0,0022	0	0,0038	0,0046	0,0054	NO	NO
BASE	8	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	8	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	8	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	8	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

Story	Point	Load	UX	UY	UZ	Δ_1	Irregularidad Torsional $1.2*(\Delta_1+\Delta_2)/2$	Irregularidad Torsional Extrema $1.4*(\Delta_1+\Delta_2)/2$	I.T.Extrema≥Δ1 >I.T.?	Δ1>I.T.Extrema?
			m	m	m	m				
N+3.45	7	COMDER1 MAX	0,0056	0,0015	0	0,0058	0,0072	0,0084	NO	NO
N+3.45	7	COMDER1 MIN	-0,0056	-0,0015	0	0,0058	0,0072	0,0084	NO	NO
N+3.45	7	COMDER2 MAX	0,0031	0,0023	0	0,0039	0,0044	0,0051	NO	NO
N+3.45	7	COMDER2 MIN	-0,0031	-0,0023	0	0,0039	0,0044	0,0051	NO	NO
BASE	7	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	7	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	7	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	7	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

Story	Point	Load	UX	UY	UZ	Δ_1	Irregularidad Torsional $1.2*(\Delta_1+\Delta_2)/2$	Irregularidad Torsional Extrema $1.4*(\Delta_1+\Delta_2)/2$	I.T.Extrema≥Δ1>I.T.?	Δ1>I.T.Extrema?
			m	m	m	m				
N+3.45	1	COMDER1 MAX	0,006	0,0015	0	0,0062	0,0078	0,0091	NO	NO
N+3.45	1	COMDER1 MIN	-0,006	-0,0015	0	0,0062	0,0078	0,0091	NO	NO
N+3.45	1	COMDER2 MAX	0,0026	0,0023	0	0,0035	0,0046	0,0054	NO	NO
N+3.45	1	COMDER2 MIN	-0,0026	-0,0023	0	0,0035	0,0046	0,0054	NO	NO
BASE	1	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	1	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	1	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	1	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

Story	Point	Load	UX	UY	UZ	Δ_1	Irregularidad Torsional $1.2*(\Delta_1+\Delta_2)/2$	Irregularidad Torsional Extrema $1.4*(\Delta_1+\Delta_2)/2$	I.T.Extrema≥Δ1>I.T.?	Δ1>I.T.Extrema?
N+3.45	75	COMDER1 MAX	0,0067	0,0014	0	0,0068	0,0082	0,0095	NO	NO
N+3.45	75	COMDER1 MIN	-0,0067	-0,0014	0	0,0068	0,0082	0,0095	NO	NO
N+3.45	75	COMDER2 MAX	0,0036	0,0023	0	0,0043	0,0051	0,0059	NO	NO
N+3.45	75	COMDER2 MIN	-0,0036	-0,0023	0	0,0043	0,0051	0,0059	NO	NO
BASE	75	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	75	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	75	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	75	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

Story	Point	Load	UX	UY	UZ	Δ_1	Irregularidad Torsional $1.2*(\Delta_1+\Delta_2)/2$	Irregularidad Torsional Extrema $1.4*(\Delta_1+\Delta_2)/2$	I.T.Extrema≥Δ1>I.T.?	Δ1>I.T.Extrema?
			m	m	m	m				
N+3.45	76	COMDER1 MAX	0,0067	0,001	0	0,0068	0,0083	0,0097	NO	NO
N+3.45	76	COMDER1 MIN	-0,0067	-0,001	0	0,0068	0,0083	0,0097	NO	NO
N+3.45	76	COMDER2 MAX	0,0036	0,0022	0	0,0042	0,0055	0,0064	NO	NO
N+3.45	76	COMDER2 MIN	-0,0036	-0,0022	0	0,0042	0,0055	0,0064	NO	NO
BASE	76	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	76	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	76	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	76	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

Story	Point	Load	UX	UY	UZ	Δ_1	Irregularidad Torsional $1.2*(\Delta_1+\Delta_2)/2$	Irregularidad Torsional Extrema $1.4*(\Delta_1+\Delta_2)/2$	I.T.Extrema≥Δ1>I.T.?	Δ1>I.T.Extrema?
			m	m	m	m				
N+3.45	77	COMDER1 MAX	0,0068	0,0019	0	0,0071	0,0087	0,0101	NO	NO
N+3.45	77	COMDER1 MIN	-0,0068	-0,0019	0	0,0071	0,0087	0,0101	NO	NO
N+3.45	77	COMDER2 MAX	0,0036	0,0034	0	0,0050	0,0067	0,0078	NO	NO
N+3.45	77	COMDER2 MIN	-0,0036	-0,0034	0	0,0050	0,0067	0,0078	NO	NO
BASE	77	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	77	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	77	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	77	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

7.3 DISEÑO DE CIMENTACIÓN

7.3.1 ELECCIÓN DE CARGAS PARA DISEÑO DE CIMENTACIÓN

DISEÑO ESTRUCTURAL DE ZAPATAS CONCÉNTRICAS INSTITUCIÓN

EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA BLOQUE A

CARGA ADMISIBLE 12.00 Ton/m^2 VERTICALES
CARGA ADMISIBLE S 15.96 Ton/m^2 SISMO

ZAPATA	B_X (m)	L_Y (m)	H (m)	Q_{MAX} (Ton/m^2) CARGA VERTICAL	Q_{MAX} (Ton/m^2) SISMO	Q_{MIN} (Ton/m^2)	CHEQUEO	TIPO DE ZAPATA	REFUERZO EN X	REFUERZO EN Y
E-2	1.30	1.30	0.30	8.87	11.36	0.84	O.K.		5 VARILLAS No. 4 L = 1.2 m. @ 30 cm.	5 VARILLAS No. 4 L = 1.2 m. @ 30 cm.
G-2	1.30	1.30	0.30	7.65	10.08	0.11	O.K.		5 VARILLAS No. 4 L = 1.2 m. @ 30 cm.	5 VARILLAS No. 4 L = 1.2 m. @ 30 cm.
E-3	1.40	1.40	0.30	11.31	15.70	0.02	O.K.		7 VARILLAS No. 4 L = 1.3 m. @ 21.67 cm.	7 VARILLAS No. 4 L = 1.3 m. @ 21.67 cm.
F-1	1.40	1.40	0.30	6.67	9.45	0.33	O.K.		5 VARILLAS No. 4 L = 1.3 m. @ 32.5 cm.	5 VARILLAS No. 4 L = 1.3 m. @ 32.5 cm.
F-2	1.40	1.40	0.30	8.42	8.63	1.98	O.K.		5 VARILLAS No. 4 L = 1.3 m. @ 32.5 cm.	5 VARILLAS No. 4 L = 1.3 m. @ 32.5 cm.
G-3	1.40	1.40	0.30	8.21	11.60	0.47	O.K.		6 VARILLAS No. 4 L = 1.3 m. @ 26 cm.	6 VARILLAS No. 4 L = 1.3 m. @ 26 cm.
G-4	1.40	1.40	0.30	9.58	9.93	0.83	O.K.		6 VARILLAS No. 4 L = 1.3 m. @ 26 cm.	6 VARILLAS No. 4 L = 1.3 m. @ 26 cm.
D-2	1.50	1.50	0.30	7.13	9.76	0.25	O.K.		6 VARILLAS No. 4 L = 1.4 m. @ 28 cm.	6 VARILLAS No. 4 L = 1.4 m. @ 28 cm.
D-3	1.50	1.50	0.30	6.66	9.66	0.01	O.K.		6 VARILLAS No. 4 L = 1.4 m. @ 28 cm.	6 VARILLAS No. 4 L = 1.4 m. @ 28 cm.
E-1	1.50	1.50	0.30	5.66	9.39	0.53	O.K.		6 VARILLAS No. 4 L = 1.4 m. @ 28 cm.	6 VARILLAS No. 4 L = 1.4 m. @ 28 cm.
E-4	1.50	1.50	0.30	10.48	15.09	0.43	O.K.		9 VARILLAS No. 4 L = 1.4 m. @ 17.5 cm.	9 VARILLAS No. 4 L = 1.4 m. @ 17.5 cm.
G-1	1.50	1.50	0.30	3.07	3.34	2.71	O.K.		5 VARILLAS No. 4 L = 1.4 m. @ 31.7 cm.	5 VARILLAS No. 4 L = 1.4 m. @ 35 cm.
D-1	1.70	1.70	0.30	5.12	8.22	0.25	O.K.		8 VARILLAS No. 4 L = 1.6 m. @ 22.86 cm.	8 VARILLAS No. 4 L = 1.6 m. @ 22.86 cm.
F-3	1.70	1.70	0.30	9.90	11.07	2.70	O.K.		10 VARILLAS No. 4 L = 1.6 m. @ 17.78 cm.	10 VARILLAS No. 4 L = 1.6 m. @ 17.78 cm.
F-4	1.70	1.70	0.30	10.47	9.13	2.70	O.K.		9 VARILLAS No. 4 L = 1.6 m. @ 20 cm.	9 VARILLAS No. 4 L = 1.6 m. @ 20 cm.
D-4	1.75	1.75	0.30	5.71	9.09	0.21	O.K.		9 VARILLAS No. 4 L = 1.65 m. @ 20.63 cm.	9 VARILLAS No. 4 L = 1.65 m. @ 20.63 cm.

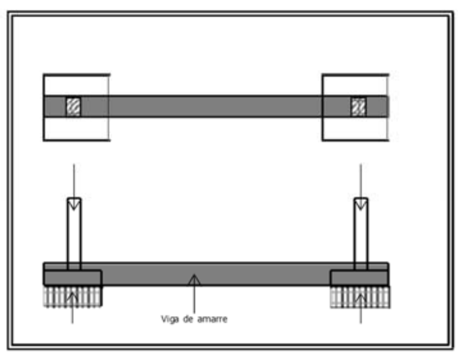
7.3.2 DISEÑOVIGASDEAMARRE

VIGA DE AMARRE TIPO

f'c = 21,1 MPa
fy = 420 MPa

b = 0,30 m
h = 0,50 m

Pmáx = 145,03 kN



De acuerdo a el numeral A.3.6.4.2
de la NSR-10 tenemos:

Aa = 0,25
Paxial = 0.25*Aa*Pmáx
Paxial = 9,064 kN

DISEÑO A TENSIÓN

As = 1.7*9.064375/(0.90*420)
As = 0,41 cm^2

DISEÑO A COMPRESIÓN

P com = 1.7*9.064375
P com = 15,4 kN

Para esta carga la sección requiere cuantía mínima:

As = 0.00333*0.3*0.45
As = 4,50 cm^2

Se suministra un refuerzo constituido por 3#5 arriba y abajo (como refuerzo mínimo).

7.3.3 DISEÑO DE ZAPATAS

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE A

ZAPATA CONCENTRICA No. P-I

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	= 2.40	Ton/m³	β =	0.85	-
Peso unitario del suelo (γ_s)	= 1.80	Ton/m³	ϕv_c =	15.02	Kg/cm²
Capacidad admisible del suelo (q_{adm})	= 12.00	Ton/m³	α_s =	20.00	-
Profundidad de desplante (D)	= 1.50	m	d =	22.50	cm
Área columnas (A_c)	= 0.24	m²	b_o =	390.00	cm
$l_{columna}$ (Sentido X)	= 40.00	cm	ϕv_c =	11.01	Kg/cm²
$l_{columna}$ (Sentido Y)	= 60.00	cm	ϕv_c =	13.05	Kg/cm²
β_c	= 1.50	-			
f_y	= 4,200.00	Kg/cm²	ϕv_c (como losa) =	11.01	Kg/cm²
f'_c	= 210.00	Kg/cm²	ϕv_c (como viga) =	6.52	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Ancho zapata en el sentido X (B_z)	m	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40
Largo zapata en el sentido Y (L_z)	m	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40
B_{zap} / B_{zap}	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
β_c columna	cm	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
β_c zapata	cm	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
L_d	cm	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
h zapata req.	m	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
h_z	m	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**
d zapata = (h_z - 0.075)	m	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Área zapata (A)	m²	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
Peso zapata (W_z = A*h_z*γ_c)	Ton	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41
Peso suelo (W_s = γ_s*(D-h_z)*(A-A_c))	Ton	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72
Pz	Ton	5.52	5.56	5.55	5.39	5.84	5.84	5.63	5.63	5.79	5.79	5.78	5.78	3.63	3.63	3.62	3.62	0.00
Peso total (W_t = Pz+W_z+W_s)	Ton	10.64	10.68	10.67	10.52	10.96	10.96	10.95	10.95	10.92	10.92	10.91	10.91	8.76	8.76	8.75	8.75	5.13
Mx	Ton-m	-0.35	-0.40	-0.39	-1.34	0.47	0.47	1.33	1.32	0.24	0.24	0.69	0.69	0.61	0.61	1.48	1.48	0.00
Fy	Ton	0.29	0.32	0.32	0.77	0.68	0.68	1.09	1.09	0.61	0.61	0.92	0.92	0.57	0.57	0.98	0.98	0.00
My	Ton-m	0.08	0.08	0.08	0.05	1.20	1.20	0.63	0.63	0.80	0.80	0.50	0.50	1.17	1.17	0.60	0.60	0.00
Fx	Ton	0.17	0.17	0.17	0.18	0.69	0.69	0.43	0.43	0.57	0.57	0.37	0.37	0.82	0.82	0.36	0.36	0.00
M'x = Mx+Fy*h_z	Ton-m	0.44	0.50	0.48	1.57	0.27	0.27	1.01	1.01	0.05	0.05	0.61	0.61	0.44	0.44	1.18	1.18	0.00
M'y = My+Fx*h_z	Ton-m	0.13	0.13	0.13	0.09	1.41	1.41	0.76	0.76	1.10	1.10	0.61	0.61	1.36	1.36	0.71	0.71	0.00
e_x = M'y/W_t	m	0.01	0.01	0.01	0.01	0.13	0.13	0.07	0.07	0.10	0.10	0.06	0.06	0.16	0.16	0.08	0.08	0.00
e_y = M'x/W_t	m	0.04	0.05	0.05	0.15	0.02	0.02	0.09	0.09	0.00	0.00	0.06	0.06	0.05	0.05	0.14	0.14	0.00
6e_x/B_z	-	0.05	0.05	0.05	0.04	0.55	0.55	0.30	0.30	0.43	0.43	0.24	0.24	0.67	0.67	0.35	0.35	0.00
6e_y/L_z	-	0.18	0.22	0.19	0.64	0.10	0.10	0.39	0.39	0.02	0.02	0.24	0.24	0.22	0.22	0.58	0.58	0.00
q_{max}	Ton/m²	**6.57**	**6.83**	**6.76**	**9.00**	**8.35**	**8.35**	**9.45**	**9.45**	**8.09**	**8.09**	**6.24**	**6.24**	**6.41**	**6.41**	**6.80**	**6.80**	**2.62**
q_{min}	Ton/m²	**4.19**	**4.08**	**4.11**	**1.75**	**1.80**	**1.80**	**1.72**	**1.72**	**3.08**	**3.08**	**2.96**	**2.96**	**3.83**	**3.83**	**0.33**	**0.33**	**2.62**
CHEQUEO CAPACIDAD ADMISIBLE	-	O.K.																

DISEÑO ZAPATA - CARGAS MAYORADAS

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
P_{zu}	Ton	7.72	8.89	7.12	7.12	7.11	7.11	5.42	5.42	5.41	5.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peso total mayorado (W_{tu})	Ton	14.90	13.07	12.50	12.50	12.49	12.49	10.80	10.80	10.79	10.79	5.38	5.38	5.38	5.38	5.38	5.38	5.38
Mx_u	Ton-m	-0.49	-0.50	0.70	0.70	1.94	1.94	0.86	0.86	2.09	2.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fy_u	Ton	0.47	0.40	0.94	0.94	1.53	1.53	0.82	0.82	1.47	1.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My_u	Ton-m	0.11	0.09	1.70	1.70	0.69	0.69	1.66	1.66	0.86	0.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fx_u	Ton	0.24	0.21	0.95	0.95	0.57	0.57	0.90	0.90	0.52	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'x_u$ = Mx_u+Fy_u*h_z	Ton-m	0.62	0.62	0.98	0.98	2.40	2.40	1.10	1.10	2.53	2.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'y_u$ = My_u+Fx_u*h_z	Ton-m	0.15	0.15	1.99	1.99	1.08	1.08	1.95	1.95	1.02	1.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{xu} = $M'y_u$/W_{tu}	m	0.01	0.01	0.16	0.16	0.09	0.09	0.18	0.18	0.09	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{yu} = $M'x_u$/W_{tu}	m	0.04	0.05	0.08	0.08	0.19	0.19	0.10	0.10	0.23	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6e_{xu}/B_z	-	0.05	0.05	0.68	0.68	0.36	0.36	0.77	0.77	0.40	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6e_{yu}/L_z	-	0.18	0.22	0.34	0.34	0.82	0.82	0.44	0.44	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
q_{umax}	Ton/m²	8.34	7.85	12.88	12.88	13.60	13.60	12.18	12.18	13.22	13.22	2.75	2.75	2.75	2.75	2.75	2.75	2.75
q_{umin}	Ton/m²	6.86	4.48	-0.12	-0.12	-1.18	-1.18	-1.18	-1.18	-3.22	-3.22	2.75	2.75	2.75	2.75	2.75	2.75	2.75

ACCION COMO VIGA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
V_u	Ton	3.60	3.02	4.96	4.96	5.30	5.30	4.69	4.69	5.04	5.04	1.06	1.06	1.06	1.06	1.06	1.06	1.06
v_u	Kg/cm²	1.14	0.96	1.57	1.57	1.70	1.70	1.49	1.49	1.60	1.60	0.34	0.34	0.34	0.34	0.34	0.34	0.34
v_u < ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN X - v_{umax}	Kg/cm²	1.70																
DIRECCION Y																		
V_u	Ton	2.28	1.90	3.18	3.18	3.41	3.41	2.99	2.99	3.24	3.24	0.67	0.67	0.67	0.67	0.67	0.67	0.67
v_u	Kg/cm²	0.73	0.61	1.02	1.02	1.08	1.08	0.95	0.95	1.03	1.03	0.21	0.21	0.21	0.21	0.21	0.21	0.21
v_u < ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN Y - v_{umax}	Kg/cm²	1.00																

ACCION COMO LOSA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
b_o	cm	390.00	390.00	390.00	390.00	390.00	390.00	390.00	390.00	390.00	390.00	390.00	390.00	390.00	390.00	390.00	390.00	390.00
V_u	Ton	13.50	11.35	18.60	18.60	20.11	20.11	17.80	17.80	19.11	19.11	3.87	3.87	3.87	3.87	3.87	3.87	3.87
v_u	Kg/cm²	3.07	1.74	2.85	2.85	3.06	3.06	2.70	2.70	2.93	2.93	0.61	0.61	0.61	0.61	0.61	0.61	0.61
v_u < ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO LOSA - v_{umax}	Kg/cm²	3.06																

DISEÑO A FLEXION EN DOS DIRECCIONES

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
M_{ux}	Ton-cm	**163.81**	**274.91**	**480.79**	**480.79**	**487.39**	**487.39**	**428.68**	**428.68**	**482.14**	**482.14**	**96.13**	**96.13**	**96.13**	**96.13**	**96.13**	**96.13**	**96.13**
K_u	Ton/cm²	0.00231	0.00369	0.00636	0.00636	0.00659	0.00659	0.00602	0.00602	0.00653	0.00653	0.00136	0.00136	0.00136	0.00136	0.00136	0.00136	0.00136
ρ_x	-	0.00060	0.00104	0.00173	0.00173	0.00187	0.00187	0.00163	0.00163	0.00177	0.00177	0.00036	0.00036	0.00036	0.00036	0.00036	0.00036	0.00036
A_{sx}	cm²	5.67	5.67	5.67	5.67	5.88	5.88	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67
Longitud de varilla	cm	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00
DIRECCION Y																		
M_{uy}	Ton-cm	**209.29**	**176.94**	**299.81**	**299.81**	**311.92**	**311.92**	**272.99**	**272.99**	**296.41**	**296.41**	**61.52**	**61.52**	**61.52**	**61.52**	**61.52**	**61.52**	**61.52**
K_u	Ton/cm²	0.00280	0.00246	0.00407	0.00407	0.00440	0.00440	0.00385	0.00385	0.00418	0.00418	0.00087	0.00087	0.00087	0.00087	0.00087	0.00087	0.00087
ρ_y	-	0.00084	0.00070	0.00118	0.00118	0.00125	0.00125	0.00109	0.00109	0.00119	0.00119	0.00024	0.00024	0.00024	0.00024	0.00024	0.00024	0.00024
A_{sy}	cm²	5.67	5.67	5.67	5.67	5.88	5.88	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67
Longitud de varilla	cm	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	**6.00**
A_{sy} Máximo	cm²	**6.00**
EN SENTIDO X USAR	-	**5 VARILLAS No. 4 L = 1.3 m. @ 32.5 cm.**
EN SENTIDO Y USAR	-	**5 VARILLAS No. 4 L = 1.3 m. @ 32.5 cm.**

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE A

ZAPATA CONCENTRICA No. F-2

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	= 2.40	Ton/m³	ϕ =	0.85	-
Peso unitario del suelo (γ_s)	= 1.80	Ton/m³	ν_c = [illegible] =	15.52	Kg/cm²
Capacidad admisible del suelo (q_{adm})	= 12.00	Ton/m²	α_s =	20.00	-
Profundidad de desplante (D)	= 1.50	m	d =	22.50	cm
Area columnas (A_c)	= 0.24	m²	b_o =	390.00	cm
[illegible] (Sección X)	= 40.00	cm	ν_c = [illegible] =	11.01	Kg/cm²
[illegible] (Sección Y)	= 60.00	cm	ν_c = [illegible] =	13.50	Kg/cm²
β_c	= 1.50	-			
f_y	= 4,200.00	Kg/cm²	ν_c (como losa) =	11.01	Kg/cm²
f'_c	= 210.00	Kg/cm²	ν_c = [illegible] (como viga) =	8.52	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		COMBINACIONES DE CARGA																
Ancho zapata en el sentido X (B_x)	m	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40
Largo zapata en el sentido Y (L_y)	m	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40
[illegible]	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
[illegible] columna	cm	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
[illegible] zapata	cm	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
[illegible]	cm	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
h zapata rec. [illegible]	m	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
h_z	m	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**
d zapata = (h_z - 0.075)	m	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Area zapata (A)	m²	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
Peso zapata (W_z = [illegible])	Ton	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41
Peso suelo (W_s = [illegible])	Ton	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72
P	Ton	6.70	6.92	6.82	6.64	6.86	6.86	6.92	6.92	6.90	6.90	6.94	6.94	4.15	4.15	4.22	4.22	0.00
Peso total (W_t = P+W_z+W_s)	Ton	11.88	11.97	11.95	11.78	11.99	11.99	12.05	12.05	12.03	12.03	12.07	12.07	9.28	9.28	9.35	9.35	5.13
Mx	Ton-m	-0.48	-0.53	-0.51	-1.37	0.02	0.02	0.73	0.73	-0.15	-0.15	0.39	0.39	0.20	0.20	0.61	0.61	0.00
Fy	Ton	0.27	0.42	0.41	0.82	0.60	0.60	0.82	0.82	0.08	0.08	0.84	0.84	0.45	0.45	0.76	0.76	0.00
My	Ton-m	-0.43	-0.43	-0.42	-0.46	0.67	0.67	0.21	0.21	0.06	0.06	0.00	0.08	1.04	1.04	0.38	0.38	0.00
Fx	Ton	-0.27	-0.27	-0.27	-0.29	0.40	0.40	0.56	0.06	0.24	0.24	-0.02	-0.02	0.51	0.51	0.17	0.17	0.00
Mx = Mx+Fy*h_z	Ton-m	0.57	0.65	0.63	1.62	0.16	0.16	0.46	0.46	0.32	0.32	0.14	0.14	0.07	0.07	0.08	0.08	0.00
My = My+Fx*h_z	Ton-m	0.51	0.51	0.51	0.55	0.99	0.99	0.23	0.23	0.03	0.03	0.05	0.05	1.19	1.19	0.43	0.43	0.00
e_x = My/W_t	m	0.04	0.04	0.04	0.05	0.08	0.08	0.02	0.02	0.05	0.05	0.00	0.00	0.13	0.13	0.05	0.05	0.00
e_y = Mx/W_t	m	0.05	0.05	0.05	0.14	0.01	0.01	0.04	0.04	0.03	0.03	0.01	0.01	0.01	0.01	0.07	0.07	0.00
6e_x/B_x	-	0.18	0.18	0.18	0.20	0.35	0.35	0.08	0.08	0.22	0.22	0.02	0.02	0.55	0.55	0.20	0.20	0.00
6e_y/L_y	-	0.20	0.23	0.23	0.59	0.06	0.06	0.16	0.16	0.11	0.11	0.05	0.05	0.03	0.03	0.31	0.31	0.00
q_{max} = [illegible]	Ton/m²	**8.43**	**8.84**	**8.58**	**10.75**	**8.85**	**8.85**	**7.84**	**7.84**	**8.21**	**8.21**	**8.50**	**8.50**	**7.49**	**7.49**	**7.26**	**7.26**	**2.62**
q_{min} = [illegible]	Ton/m²	**3.71**	**3.57**	**3.60**	**1.26**	**3.60**	**3.60**	**4.56**	**4.56**	**4.06**	**4.06**	**5.74**	**5.74**	**1.96**	**1.96**	**2.34**	**2.34**	**2.62**
CHEQUEO CAPACIDAD ADMISIBLE	-	O.K.																

DISEÑO ZAPATA - CARGAS MAYORADAS

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
P_U	Ton	9.49	8.24	8.34	8.24	8.43	8.43	8.22	8.22	8.32	8.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peso total mayorado (W_{tu} = [illegible])	Ton	16.04	13.63	13.72	13.72	13.81	13.81	11.61	11.61	11.70	11.70	5.38	5.38	5.38	5.38	5.38	5.38	5.38
Mx_U	Ton-m	-0.04	-0.05	0.06	0.06	1.06	1.06	0.27	0.27	1.29	1.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fy_U	Ton	0.52	0.52	0.82	0.82	1.20	1.20	0.86	0.86	1.14	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My_U	Ton-m	-0.60	-0.51	1.34	1.34	0.40	0.40	1.47	1.47	0.53	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fx_U	Ton	-0.38	-0.32	0.62	0.62	0.15	0.15	0.71	0.71	0.23	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mx_U = Mx_U+Fy_U*h_z	Ton-m	0.80	0.62	0.31	0.31	1.47	1.47	0.47	0.47	1.83	1.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My_U = My_U+Fx_U*h_z	Ton-m	0.71	0.61	1.53	1.53	0.44	0.44	1.88	1.88	0.80	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{xU} = My_U/W_{tU}	m	0.04	0.04	0.11	0.11	0.03	0.03	0.14	0.14	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{yU} = Mx_U/W_{tU}	m	0.05	0.05	0.02	0.02	0.11	0.11	0.04	0.04	0.14	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6e_{xU}/B_x	-	0.18	0.19	0.48	0.48	0.14	0.14	0.62	0.62	0.22	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6e_{yU}/L_y	-	0.20	0.38	0.10	0.10	0.46	0.46	0.17	0.17	0.60	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00
q_{Umax} = [illegible]	Ton/m²	11.78	10.07	11.02	11.02	11.23	11.23	10.62	10.62	10.83	10.83	2.75	2.75	2.75	2.75	2.75	2.75	2.75
q_{Umin} = [illegible]	Ton/m²	5.19	3.83	2.98	2.98	2.86	2.86	1.23	1.23	1.11	1.11	2.75	2.75	2.75	2.75	2.75	2.75	2.75

ACCION COMO VIGA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
V_U = [illegible]	Ton	4.54	3.88	4.24	4.24	4.32	4.32	4.09	4.09	4.17	4.17	1.08	1.08	1.08	1.08	1.08	1.08	1.08
ν_U = [illegible]	Kg/cm²	1.44	1.23	1.35	1.35	1.37	1.37	1.30	1.30	1.32	1.32	0.34	0.34	0.34	0.34	0.34	0.34	0.34
ν_U < $\phi\nu_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN X - ν_{Umax}	Kg/cm²	1.44																
DIRECCION Y																		
V_U = [illegible]	Ton	2.88	2.47	2.70	2.70	2.75	2.75	2.60	2.60	2.65	2.65	0.67	0.67	0.67	0.67	0.67	0.67	0.67
ν_U = [illegible]	Kg/cm²	0.92	0.79	0.86	0.86	0.87	0.87	0.83	0.83	0.84	0.84	0.21	0.21	0.21	0.21	0.21	0.21	0.21
ν_U < $\phi\nu_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN Y - ν_{Umax}	Kg/cm²	0.92																

ACCION COMO LOSA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
b_o	cm	390.00	390.00	390.00	390.00	390.00	390.00	390.00	390.00	390.00	390.00	390.00	390.00	390.00	390.00	390.00	390.00	390.00
V_U = [illegible]	Ton	17.00	14.55	15.90	15.90	16.22	16.22	15.34	15.34	15.65	15.65	3.97	3.97	3.97	3.97	3.97	3.97	3.97
ν_U = [illegible]	Kg/cm²	2.61	2.23	2.44	2.44	2.49	2.49	2.35	2.35	2.40	2.40	0.61	0.61	0.61	0.61	0.61	0.61	0.61
ν_U < $\phi\nu_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO LOSA - ν_{Umax}	Kg/cm²	2.61																

DISEÑO A FLEXION EN DOS DIRECCIONES

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
M_{UX} = [illegible]	Ton-cm	**306.17**	**262.02**	**286.80**	**286.80**	**292.11**	**292.11**	**271.86**	**271.86**	**276.11**	**276.11**	**66.12**	**66.12**	**66.12**	**66.12**	**66.12**	**66.12**	**66.12**
K_U = [illegible]	Ton/cm²	0.00581	0.00497	0.00544	0.00544	0.00555	0.00555	0.00525	0.00525	0.00535	0.00535	0.00126	0.00126	0.00126	0.00126	0.00126	0.00126	0.00126
ρ_x = [illegible] ≥ 0.0018	-	0.00157	0.00134	0.00147	0.00147	0.00150	0.00150	0.00142	0.00142	0.00144	0.00144	0.00035	0.00035	0.00035	0.00035	0.00035	0.00035	0.00035
A_{sx} = [illegible]	cm²	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67
Longitud de varilla = B_x - 10	cm	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00
DIRECCION Y																		
M_{UY} = [illegible]	Ton-cm	**283.90**	**235.81**	**248.91**	**248.91**	**251.84**	**251.84**	**237.96**	**237.96**	**242.83**	**242.83**	**61.82**	**61.82**	**61.82**	**61.82**	**61.82**	**61.82**	**61.82**
K_U = [illegible]	Ton/cm²	0.00372	0.00318	0.00348	0.00348	0.00355	0.00355	0.00336	0.00336	0.00342	0.00342	0.00087	0.00087	0.00087	0.00087	0.00087	0.00087	0.00087
ρ_y = [illegible] ≥ 0.0018	-	0.00106	0.00090	0.00099	0.00099	0.00101	0.00101	0.00095	0.00095	0.00097	0.00097	0.00024	0.00024	0.00024	0.00024	0.00024	0.00024	0.00024
A_{sy} = [illegible]	cm²	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67
Longitud de varilla = L_y - 10	cm	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	5.67
A_{sy} Máximo	cm²	5.67
EN SENTIDO X USAR	-	5 VARILLAS No. 4 L = 1.3 m. @ 32.5 cm.
EN SENTIDO Y USAR	-	5 VARILLAS No. 4 L = 1.3 m. @ 32.5 cm.

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE A

ZAPATA CONCENTRICA No. P2

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	=	2.40	Ton/m³	α_s =	0.00	-
Peso unitario del suelo (γ_s)	=	1.80	Ton/m³	$\phi v_c = \phi*0.27*(2+4/\beta_c)*f'_c{}^{0.5}$ =	15.52	Kg/cm²
Capacidad admisible del suelo (q_{adm})	=	12.00	Ton/m³	α_s =	20.00	-
Profundidad de desplante (D)	=	1.50	m.	d =	22.50	cm.
Area columnas (A_c)	=	0.24	m²	b_o =	280.00	cm.
$b_{columna}$ (Sentido X)	=	40.00	cm	$\phi v_c = \phi*0.27*(2+\alpha_s*d/b_o)*f'_c{}^{0.5}$ =	11.81	Kg/cm²
$l_{columna}$ (Sentido Y)	=	60.00	cm	$\phi v_c = \phi*1.1*f'_c{}^{0.5}$ =	13.55	Kg/cm²
β_c	=	1.50	-			
f_y	=	4,200.00	Kg/cm²	ϕv_c (como losa) =	11.81	Kg/cm²
f'_c	=	210.00	Kg/cm²	$\phi v_c = \phi*0.53*f'_c{}^{0.5}$ (como viga) =	6.53	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		COMBINACIONES DE CARGA																
Ancho zapata en el sentido X (B_x)	m.	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70
Largo zapata en el sentido Y (L_y)	m.	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70
B_x / L_y	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
β_c columna	cm.	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
β_c zapata	cm.	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
d = ...	cm.	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
h zapata req. H = ...	m.	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
h_z	m.	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**
d zapata = h_z - 0.075	m.	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Area zapata (A)	m²	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89
Peso zapata ($W_z = A*h_z*\gamma_c$)	Ton	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08
Peso suelo ($W_s = \gamma_s*(A-A_c)*(D-h_z)$)	Ton	5.72	5.72	5.72	5.72	5.72	5.72	5.72	5.72	5.72	5.72	5.72	5.72	5.72	5.72	5.72	5.72	5.72
Fz	Ton	13.56	13.65	13.62	13.56	13.66	13.66	13.75	13.75	13.70	13.70	13.76	13.76	8.24	8.24	8.32	8.32	0.00
Peso total (Wt = Fz+Wz+Ws)	Ton	21.37	21.45	21.42	21.37	21.47	21.47	21.55	21.55	21.51	21.51	21.57	21.57	16.05	16.05	16.13	16.13	7.80
Mx	Ton-m	-1.15	-1.17	-1.15	-1.96	-0.43	-0.43	0.36	0.36	-0.84	-0.84	-0.05	-0.05	0.01	0.01	0.80	0.80	0.00
Fy	Ton	0.60	0.66	0.67	1.26	1.25	1.25	1.62	1.62	1.21	1.21	1.49	1.49	0.88	0.88	1.25	1.25	0.00
My	Ton-m	0.51	0.51	0.51	0.46	1.87	1.87	1.15	1.15	1.49	1.49	1.00	1.00	1.60	1.60	0.94	0.94	0.00
Fx	Ton	0.55	0.55	0.55	0.52	1.22	1.22	0.88	0.88	1.06	1.06	0.80	0.80	1.00	1.00	0.86	0.86	0.00
M'x = Mx+Fy*h_z	Ton-m	1.38	1.46	1.44	2.40	0.81	0.81	0.13	0.13	1.01	1.01	0.50	0.50	0.25	0.25	0.42	0.42	0.00
M'y = My+Fx*h_z	Ton-m	0.67	0.67	0.67	0.64	2.17	2.17	1.41	1.41	1.81	1.81	1.24	1.24	1.90	1.90	1.14	1.14	0.00
e_x = M'y/W_t	m.	0.03	0.03	0.03	0.03	0.10	0.10	0.07	0.07	0.08	0.08	0.06	0.06	0.12	0.12	0.07	0.07	0.00
e_y = M'x/W_t	m.	0.06	0.07	0.07	0.11	0.04	0.04	0.01	0.01	0.05	0.05	0.02	0.02	0.02	0.02	0.03	0.03	0.00
$6e_x/B_x$	-	0.11	0.11	0.11	0.10	0.36	0.36	0.23	0.23	0.30	0.30	0.20	0.20	0.42	0.42	0.25	0.25	0.00
$6e_y/L_y$	-	0.23	0.24	0.24	0.40	0.13	0.13	0.02	0.02	0.17	0.17	0.08	0.08	0.06	0.06	0.09	0.09	0.00
q_{max} =(Wt/(Bx*Ly))*(1+6ex/Bx+6ey/Ly)	Ton/m²	**9.80**	**10.04**	**10.00**	**11.10**	**11.07**	**11.07**	**8.34**	**8.34**	**10.35**	**10.35**	**8.60**	**8.60**	**8.19**	**8.19**	**7.49**	**7.49**	**2.73**
q_{min} =(Wt/(Bx*Ly))*(1-6ex/Bx-6ey/Ly)	Ton/m²	**4.80**	**4.81**	**4.83**	**3.86**	**3.79**	**3.79**	**6.67**	**6.67**	**4.00**	**4.00**	**6.36**	**6.36**	**2.82**	**2.82**	**3.67**	**3.67**	**2.73**
CHEQUEO CAPACIDAD ADMISIBLE	-	O.K.																

DISEÑO ZAPATA - CARGAS MAYORADAS

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
$F_{z,u}$	Ton	18.98	18.41	18.31	18.31	18.60	18.60	12.35	12.35	12.47	12.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peso total mayorado ($W_u = F_{z,u}+W_{z,u}+W_{s,u}$)	Ton	26.91	24.80	24.75	24.75	24.82	24.82	20.58	20.55	20.98	20.98	8.20	8.20	8.20	8.20	8.20	8.20	8.20
Mx_u	Ton-m	-1.54	-1.43	-0.43	-0.43	0.70	0.70	-0.04	-0.04	1.09	1.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fy_u	Ton	1.26	1.20	1.62	1.62	2.16	2.16	1.29	1.29	1.63	1.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My_u	Ton-m	0.77	0.81	2.48	2.48	1.52	1.52	2.31	2.31	1.37	1.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fx_u	Ton	0.77	0.86	1.42	1.62	1.13	1.13	1.45	1.45	0.97	0.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'x_u = Mx_u+Fy_u*h_z$	Ton-m	1.92	1.79	0.92	0.92	1.34	1.34	0.42	0.42	1.58	1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'y_u = My_u+Fx_u*h_z$	Ton-m	0.94	0.81	2.95	2.95	1.86	1.86	2.75	2.75	1.66	1.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$e_{xu} = M'y_u/W_u$	m.	0.03	0.03	0.12	0.12	0.08	0.08	0.13	0.13	0.08	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$e_{yu} = M'x_u/W_u$	m.	0.06	0.07	0.04	0.04	0.05	0.05	0.02	0.02	0.08	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{xu}/B_x$	-	0.11	0.12	0.42	0.42	0.27	0.27	0.47	0.47	0.28	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{yu}/L_y$	-	0.23	0.26	0.13	0.13	0.19	0.19	0.07	0.07	0.28	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00
q_{umax} =(Wu/(Bx*Ly))*(1+6exu/Bx+6eyu/Ly)	Ton/m²	13.87	11.89	13.27	13.27	12.50	12.50	10.98	10.98	11.18	11.18	2.84	2.84	2.84	2.84	2.84	2.84	2.84
q_{umin} =(Wu/(Bx*Ly))*(1-6exu/Bx-6eyu/Ly)	Ton/m²	6.92	5.34	3.62	3.62	4.67	4.67	3.24	3.24	3.12	3.12	2.84	2.84	2.84	2.84	2.84	2.84	2.84

ACCION COMO VIGA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
$V_u = q_{umax}*L_y*(B_x/2-b_c/2-d)$	Ton	10.02	8.46	9.59	9.59	9.03	9.03	7.93	7.93	8.08	8.08	2.05	2.05	2.05	2.05	2.05	2.05	2.05
$v_u = V_u/(L_y*d)$	Kg/cm²	2.62	2.21	2.51	2.51	2.36	2.36	2.07	2.07	2.11	2.11	0.54	0.54	0.54	0.54	0.54	0.54	0.54
$v_u \leq \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN X - V_{umax}	Kg/cm²	2.62																
DIRECCION Y																		
$V_u = q_{umax}*B_x*(L_y/2-l_c/2-d)$	Ton	7.66	6.46	7.33	7.33	6.91	6.91	6.07	6.07	6.18	6.18	1.57	1.57	1.57	1.57	1.57	1.57	1.57
$v_u = V_u/(B_x*d)$	Kg/cm²	2.00	1.69	1.92	1.92	1.81	1.81	1.59	1.59	1.62	1.62	0.41	0.41	0.41	0.41	0.41	0.41	0.41
$v_u \leq \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN Y - V_{umax}	Kg/cm²	2.00																

ACCION COMO LOSA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
b_o	cm.	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00
$V_u = q_{umax}*(A-(b_c+d)*(l_c+d))$	Ton	32.92	27.75	31.51	31.51	29.69	29.69	26.07	26.07	25.58	25.58	6.73	6.73	6.73	6.73	6.73	6.73	6.73
$v_u = V_u/(b_o*d)$	Kg/cm²	5.05	4.35	4.83	4.83	4.55	4.55	4.00	4.00	4.07	4.07	1.03	1.03	1.03	1.03	1.03	1.03	1.03
$v_u \leq \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO LOSA - v_{umax}	Kg/cm²	5.05																

DISEÑO A FLEXION EN DOS DIRECCIONES

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
$M_{ux} = q_{umax}*L_y*(B_x/2-b_c/2)^2/2$	Ton-cm	**887.94**	**838.59**	**983.32**	**983.32**	**896.02**	**896.02**	**795.65**	**795.65**	**803.20**	**803.20**	**200.87**	**200.87**	**200.87**	**200.87**	**200.87**	**200.87**	**200.87**
$K_x = M_{ux}/(L_y*d^2)$	Ton/m²	0.00979	0.00915	0.01108	0.01108	0.01040	0.01040	0.00919	0.00910	0.00930	0.00930	0.00237	0.00237	0.00237	0.00237	0.00237	0.00237	0.00237
ρ_x = ... ≥ 0.0018	-	0.00158	0.00267	0.00308	0.00305	0.00287	0.00287	0.00251	0.00251	0.00255	0.00255	0.00063	0.00063	0.00063	0.00063	0.00063	0.00063	0.00063
$A_{sx} = \rho_x*L_y*d$	cm²	8.89	10.22	11.88	11.88	10.96	10.96	9.58	9.58	8.77	8.77	6.89	6.89	6.89	6.89	6.89	6.89	6.89
Longitud de varilla = B_x - 10	cm.	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00
DIRECCION Y																		
$M_{uy} = q_{umax}*B_x*(L_y/2-l_c/2)^2/2$	Ton-cm	**713.02**	**801.13**	**882.88**	**882.88**	**842.96**	**842.96**	**584.85**	**584.85**	**675.14**	**675.14**	**145.03**	**145.03**	**145.03**	**145.03**	**145.03**	**145.03**	**145.03**
$K_y = M_{uy}/(B_x*d^2)$	Ton/m²	0.00829	0.00898	0.00790	0.00790	0.00747	0.00747	0.00658	0.00658	0.00669	0.00669	0.00159	0.00159	0.00159	0.00159	0.00159	0.00159	0.00159
ρ_y = ... ≥ 0.0018	-	0.00236	0.00260	0.00228	0.00228	0.00215	0.00215	0.00188	0.00188	0.00142	0.00190	0.00048	0.00048	0.00048	0.00048	0.00048	0.00048	0.00048
$A_{sy} = \rho_y*B_x*d$	cm²	8.59	10.22	11.88	11.88	10.96	10.98	9.58	9.58	8.77	8.77	6.89	6.89	6.89	6.89	6.89	6.89	6.89
Longitud de varilla = L_y - 10	cm.	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	**11.88**
A_{sy} Máximo	cm²	**11.88**
EN SENTIDO X USAR	-	**10 VARILLAS No. 4 L = 1.6 m. @ 17.75 cm.**
EN SENTIDO Y USAR	-	**10 VARILLAS No. 4 L = 1.6 m. @ 17.75 cm.**

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE A

ZAPATA CONCENTRICA No. F4

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	= 2.40	Ton/m³	β =	0.85	-
Peso unitario del suelo (γ_s)	= 1.80	Ton/m³	ϕv_c =	15.50	Kg/cm²
Capacidad admisible del suelo (q_{adm})	= 12.00	Ton/m²	α_s =	20.00	-
Profundidad de desplante (D)	= 1.50	m.	d =	22.50	cm.
Area columna (A_c)	= 0.24	m²	b_o =	260.00	cm.
$b_{columna}$ (Sentido X)	= 40.00	cm.	ϕv_c =	11.91	Kg/cm²
$h_{columna}$ (Sentido Y)	= 60.00	cm.	ϕv_c =	13.50	Kg/cm²
β_c	= 1.50	-			
f_y	= 4,200.00	Kg/cm²	ϕv_c (como losa) =	11.91	Kg/cm²
f'_c	= 210.00	Kg/cm²	ϕv_c (como viga) =	6.53	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		COMBINACIONES DE CARGA																
Ancho zapata en el sentido X (B_z)	m.	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70
Largo zapata en el sentido Y (L_z)	m.	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70
B_{zap} / A_{zap}	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
I_c columna	cm.	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
I_z zapata	cm.	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
H	cm.	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
h zapata req.	m.	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58
h_z	m.	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
d zapata = (h_z - 0.075)	m.	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Area zapata (A)	m²	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89
Peso zapata (W_z)	Ton	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08
Peso suelo (W_s)	Ton	5.73	5.73	5.73	5.73	5.73	5.73	5.73	5.73	5.73	5.73	5.73	5.73	5.73	5.73	5.73	5.73	5.73
Fz	Ton	14.76	14.79	14.76	14.88	15.12	15.12	15.16	15.16	15.05	15.05	15.09	15.09	9.22	9.22	9.25	9.25	0.00
Peso total (W_t + Fz+W_s+W_z)	Ton	22.57	22.59	22.59	22.68	22.93	22.93	22.96	22.96	22.86	22.86	22.89	22.89	17.02	17.02	17.06	17.06	7.80
Mx	Ton-m	-1.15	-1.19	-1.18	-1.94	0.01	0.01	1.12	1.12	-0.29	-0.29	0.55	0.55	0.47	0.47	1.58	1.58	0.00
Fy	Ton	0.96	0.96	0.96	1.38	1.52	1.52	2.05	2.05	1.40	1.40	1.81	1.81	1.14	1.14	1.87	1.87	0.00
My	Ton-m	-0.07	-0.81	-0.81	-0.64	0.51	0.51	-0.07	-0.07	0.26	0.24	-0.20	-0.20	0.75	0.75	0.18	0.18	0.00
Fx	Ton	-0.43	-0.43	-0.43	-0.45	0.09	0.09	-0.16	-0.16	-0.04	-0.04	-0.24	-0.24	0.26	0.26	-0.01	-0.01	0.00
M'x = Mx+Fy*h_z	Ton-m	1.44	1.48	1.47	2.38	0.44	0.44	0.51	0.51	0.71	0.71	0.00	0.00	0.13	0.13	1.08	1.08	0.00
M'y = My+Fx*h_z	Ton-m	0.74	0.74	0.74	0.78	0.54	0.54	0.12	0.12	0.23	0.23	0.27	0.27	0.83	0.83	0.18	0.18	0.00
e_x = M'y/W_t	m.	0.03	0.03	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.05	0.05	0.01	0.01	0.00
e_y = M'x/W_t	m.	0.06	0.07	0.07	0.10	0.02	0.02	0.02	0.02	0.03	0.03	0.00	0.00	0.01	0.01	0.06	0.06	0.00
$6e_x/B_z$	-	0.12	0.12	0.12	0.12	0.08	0.08	0.02	0.02	0.03	0.03	0.04	0.04	0.17	0.17	0.04	0.04	0.00
$6e_y/L_z$	-	0.22	0.23	0.23	0.37	0.07	0.07	0.08	0.08	0.11	0.11	0.00	0.00	0.03	0.03	0.22	0.22	0.00
q_{max} = (W_t/(B_z*L_z))*(1+$6e_x/B_z$+$6e_y/L_z$)	Ton/m²	10.47	10.83	10.83	11.88	9.13	9.13	8.71	8.71	9.06	9.06	8.28	8.28	7.27	7.27	7.44	7.44	2.70
q_{min} = (W_t/(B_z*L_z))*(1-$6e_x/B_z$-$6e_y/L_z$)	Ton/m²	5.15	5.15	5.11	4.02	6.74	6.74	7.18	7.18	6.76	6.76	7.60	7.60	4.71	4.71	4.26	4.26	2.70
CHEQUEO CAPACIDAD ADMISIBLE	-	O.K.																
DISEÑO ZAPATA - CARGAS MAYORADAS																		
Fz_u	Ton	20.67	17.76	16.25	16.25	16.21	16.21	13.80	13.80	13.65	13.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peso total mayorado (W_u + Fz_u+W_{su}+W_{zu})	Ton	31.38	25.95	26.45	26.45	26.50	26.50	21.98	21.98	22.05	22.05	8.20	8.20	8.20	8.20	8.20	8.20	8.20
Mx_u	Ton-m	-1.87	-1.44	0.24	0.24	1.83	1.83	0.63	0.63	2.21	2.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fy_u	Ton	1.38	1.19	1.97	1.97	2.74	2.74	1.86	1.86	2.43	2.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My_u	Ton-m	-0.86	-0.74	0.97	0.97	0.05	0.05	1.05	1.05	0.23	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fx_u	Ton	-0.60	-0.52	0.22	0.22	-0.18	-0.18	0.35	0.35	-0.03	-0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'x_u$ = Mx_u+Fy_u*h_z	Ton-m	2.01	1.79	0.84	0.84	2.86	2.86	1.12	1.12	2.94	2.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'y_u$ = My_u+Fx_u*h_z	Ton-m	1.04	0.89	0.80	0.80	0.09	0.09	1.16	1.16	0.24	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{xu} = $M'y_u$/W_u	m.	0.03	0.03	0.04	0.04	0.00	0.00	0.05	0.05	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{yu} = $M'x_u$/W_u	m.	0.06	0.07	0.03	0.03	0.10	0.10	0.05	0.05	0.13	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{xu}/B_z$	-	0.12	0.12	0.13	0.13	0.01	0.01	0.18	0.18	0.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{yu}/L_z$	-	0.22	0.24	0.11	0.11	0.35	0.35	0.19	0.19	0.47	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00
q_{umax} = (W_u/(B_z*L_z))*(1+$6e_{xu}/B_z$+$6e_{yu}/L_z$)	Ton/m²	14.66	12.28	11.31	11.31	12.53	12.53	10.40	10.40	11.51	11.51	2.84	2.84	2.84	2.84	2.84	2.84	2.84
q_{umin} = (W_u/(B_z*L_z))*(1-$6e_{xu}/B_z$-$6e_{yu}/L_z$)	Ton/m²	7.20	5.75	6.99	6.99	5.81	5.81	4.62	4.62	3.74	3.74	2.84	2.84	2.84	2.84	2.84	2.84	2.84
ACCION COMO VIGA																		
DIRECCION X																		
V_u	Ton	10.59	8.88	8.17	8.17	9.05	9.05	7.01	7.01	8.32	8.32	2.05	2.05	2.05	2.05	2.05	2.05	2.05
v_u = V_u/(L_z*d)	Kg/cm²	2.77	2.32	2.14	2.14	2.37	2.37	1.96	1.96	2.17	2.17	0.54	0.54	0.54	0.54	0.54	0.54	0.54
$v_u \le \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN X - v_{umax}	Kg/cm²	2.77																
DIRECCION Y																		
V_u	Ton	8.10	6.77	6.35	6.35	6.92	6.92	5.74	5.74	6.36	6.36	1.57	1.57	1.57	1.57	1.57	1.57	1.57
v_u = V_u/(B_z*d)	Kg/cm²	2.12	1.77	1.63	1.63	1.81	1.81	1.50	1.50	1.66	1.66	0.41	0.41	0.41	0.41	0.41	0.41	0.41
$v_u \le \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN Y - v_{umax}	Kg/cm²	2.12																
ACCION COMO LOSA																		
b_o	cm.	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00
V_u	Ton	34.81	29.11	26.87	26.87	29.75	29.75	24.68	24.68	27.34	27.34	6.73	6.73	6.73	6.73	6.73	6.73	6.73
v_u = V_u/(b_o*d)	Kg/cm²	5.33	4.46	4.12	4.12	4.56	4.56	3.78	3.78	4.19	4.19	1.03	1.03	1.03	1.03	1.03	1.03	1.03
$v_u \le \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO LOSA - v_{umax}	Kg/cm²	5.33																
DISEÑO A FLEXION EN DOS DIRECCIONES																		
DIRECCION X																		
M_{ux}	Ton-cm	828.47	693.43	612.59	612.59	699.79	699.79	746.89	746.89	628.86	628.86	203.87	203.87	203.87	203.87	203.87	203.87	203.87
K_u	Ton/m²	0.00612	0.01020	0.00944	0.00944	0.01046	0.01046	0.00858	0.00858	0.00961	0.00961	0.00237	0.00237	0.00237	0.00237	0.00237	0.00237	0.00237
ρ_x ≥ 0.0018	-	0.00156	0.00081	0.00059	0.00059	0.00267	0.00267	0.00237	0.00237	0.00263	0.00263	0.00063	0.00063	0.00063	0.00063	0.00063	0.00063	0.00063
A_{sx}	cm²	8.89	10.74	9.68	9.68	12.88	12.88	9.08	9.08	10.06	10.06	8.89	8.89	8.89	8.89	8.89	8.89	8.89
Longitud de varilla = B_z - 10	cm.	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00
DIRECCION Y																		
M_{uy}	Ton-cm	763.85	630.27	601.27	601.27	644.23	644.23	634.81	634.81	592.10	592.10	145.83	145.83	145.83	145.83	145.83	145.83	145.83
K_u	Ton/m²	0.00876	0.00733	0.00676	0.00676	0.00749	0.00749	0.00621	0.00621	0.00688	0.00688	0.00169	0.00169	0.00169	0.00169	0.00169	0.00169	0.00169
ρ_y ≥ 0.0018	-	0.00253	0.00212	0.00194	0.00194	0.00215	0.00215	0.00178	0.00178	0.00197	0.00197	0.00048	0.00048	0.00048	0.00048	0.00048	0.00048	0.00048
A_{sy}	cm²	8.89	10.74	9.68	9.68	12.88	12.88	9.08	9.08	10.06	10.06	8.89	8.89	8.89	8.89	8.89	8.89	8.89
Longitud de varilla = L_z - 10	cm.	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	10.26
A_{sy} Máximo	cm²	10.26
EN SENTIDO X USAR	-	9 VARILLAS No. 4 L = 1.6 m. @ 20 cms.
EN SENTIDO Y USAR	-	9 VARILLAS No. 4 L = 1.6 m. @ 20 cms.

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE A

ZAPATA CONCENTRICA No. Z-1

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	= 2.40	Ton/m³		α =	0.85	-
Peso unitario del suelo (γ_s)	= 1.80	Ton/m³		ϕv_c =	15.52	Kg/cm²
Capacidad admisible del suelo (q_{adm})	= 12.00	Ton/m²		α_s =	20.00	-
Profundidad de desplante (D)	= 1.50	m.		d =	22.50	cm.
Area columnas (A_c)	= 0.24	m²		b_o =	260.00	cm.
b_{colum} (Sentido X)	= 40.00	cm.		ϕv_c =	11.81	Kg/cm²
h_{colum} (Sentido Y)	= 60.00	cm.		ϕv_c =	13.55	Kg/cm²
β_c	= 1.50	-				
f_y	= 4,200.00	Kg/cm²		ϕv_c (como losa) =	11.81	Kg/cm²
f'_c	= 210.00	Kg/cm²		ϕv_c (como viga) =	8.55	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

COMBINACIONES DE CARGA 1–17

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Ancho zapata en el sentido X (B_x)	m.	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Largo zapata en el sentido Y (L_y)	m.	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
B_{zap} / A_{zap}	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d_b columna	cm.	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
d_b zapata	cm.	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
l_d	cm.	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
h zapata req.	m.	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58
h_z	m.	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30

[illegible]

DISEÑO ZAPATA - CARGAS MAYORADAS

[illegible]

ACCION COMO VIGA

CHEQUEO ACCION COMO VIGA EN X - V_{umax} | Kg/cm² | 1.56

CHEQUEO ACCION COMO VIGA EN Y - V_{umax} | Kg/cm² | 1.29

ACCION COMO LOSA

CHEQUEO ACCION COMO LOSA - V_{umax} | Kg/cm² | 3.42

DISEÑO A FLEXION EN DOS DIRECCIONES

[illegible]

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	7.05
A_{sy} Máximo	cm²	7.05
EN SENTIDO X USAR	-	6 VARILLAS No. 4 L = 1.4 m. @ 25 cm.
EN SENTIDO Y USAR	-	6 VARILLAS No. 4 L = 1.4 m. @ 25 cm.

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARÍA INMACULADA - BLOQUE A

ZAPATA CONCENTRICA No. Z2

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	= 2.40	Ton/m³	ϕ =	0.85	-
Peso unitario del suelo (γ_s)	= 1.80	Ton/m³	$\phi v_c = \phi*0.27*(2+4/\beta_c)*f'_c{}^{0.5}$ =	15.52	Kg/cm²
Capacidad admisible del suelo (q_{adm})	= 12.00	Ton/m³	α_s =	20.00	-
Profundidad de desplante (D)	= 1.50	m.	d =	22.50	cm.
Area columnas (A_c)	= 0.24	m²	b_o =	290.00	cm.
$b_{columna}$ (Sentido X)	= 40.00	cm.	$\phi v_c = \phi*0.27*(2+\alpha_s*d/b_o)*f'_c{}^{0.5}$ =	11.81	Kg/cm²
$h_{columna}$ (Sentido Y)	= 60.00	cm.	$\phi v_c = \phi*1.1*f'_c{}^{0.5}$ =	13.55	Kg/cm²
β_c	= 1.50	-			
f_y	= 4,200.00	Kg/cm²	ϕv_c (como losa) =	11.81	Kg/cm²
f'_c	= 210.00	Kg/cm²	$\phi v_c = \phi*0.53*f'_c{}^{0.5}$ (como viga) =	6.53	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		COMBINACIONES DE CARGA																
Ancho zapata en el sentido X (B_x)	m.	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30
Largo zapata en el sentido Y (L_y)	m.	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30
B_{zap}/L_{zap}	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
β_c columna	cm.	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
β_c zapata	cm.	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
d = ...	cm.	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
h zapata req.	m.	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
h_z	m.	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
d zapata = (h_z - 0.075)	m.	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Area zapata (A)	m²	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69
Peso zapata ($W_z = A*h_z*\gamma_c$)	Ton	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
Peso suelo ($W_s = \gamma_s*(A-A_c)*(D-h_z)$)	Ton	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13
Fz	Ton	7.73	7.95	7.89	7.37	7.79	7.79	7.77	7.77	7.94	7.94	7.92	7.92	4.70	4.70	4.69	4.69	0.00
Peso total (Wt = Fz+Ws+Wz)	Ton	12.08	12.30	12.24	11.72	12.14	12.14	12.12	12.12	12.29	12.29	12.27	12.27	9.05	9.05	9.02	9.02	4.35
Mx	Ton-m	0.12	0.18	0.17	-0.02	0.58	0.58	1.26	1.26	0.53	0.53	1.03	1.03	0.53	0.53	1.21	1.21	0.00
Fy	Ton	-0.15	-0.21	-0.20	0.34	0.05	0.05	0.37	0.37	-0.04	-0.04	0.20	0.20	0.12	0.12	0.42	0.42	0.00
My	Ton-m	-0.40	-0.40	-0.40	-0.38	0.85	0.85	0.28	0.28	0.05	0.05	0.12	0.12	1.01	1.01	0.44	0.44	0.00
Fx	Ton	-0.23	-0.23	-0.22	-0.23	0.41	0.41	0.11	0.11	0.35	0.35	0.53	0.53	0.50	0.50	0.21	0.21	0.00
M'x = Mx+Fy*h_z	Ton-m	0.16	0.26	0.23	0.33	0.56	0.56	1.15	1.15	0.53	0.53	0.97	0.97	0.49	0.49	1.08	1.08	0.00
M'y = My+Fx*h_z	Ton-m	0.47	0.47	0.47	0.45	0.97	0.97	0.31	0.31	0.62	0.62	0.13	0.13	1.16	1.16	0.50	0.50	0.00
e_x = M'y/Wt	m.	0.04	0.04	0.04	0.04	0.08	0.08	0.03	0.03	0.05	0.05	0.01	0.01	0.13	0.13	0.06	0.06	0.00
e_y = M'x/Wt	m.	0.01	0.02	0.02	0.03	0.05	0.05	0.09	0.09	0.04	0.04	0.08	0.08	0.05	0.05	0.12	0.12	0.00
$6e_x/B_x$	-	0.18	0.18	0.18	0.18	0.37	0.37	0.12	0.12	0.23	0.23	0.05	0.05	0.59	0.59	0.25	0.25	0.00
$6e_y/L_y$	-	0.06	0.09	0.09	0.38	0.21	0.21	0.44	0.44	0.20	0.20	0.37	0.37	0.25	0.25	0.55	0.55	0.00
q_{max} = (Wt/(B_x*L_y))*(1+$6e_x/B_x$+$6e_y/L_y$)	Ton/m²	8.87	9.22	9.14	10.89	11.38	11.38	11.15	11.15	10.41	10.41	10.28	10.28	8.85	8.85	9.60	9.60	2.57
q_{min} = (Wt/(B_x*L_y))*(1-$6e_x/B_x$-$6e_y/L_y$)	Ton/m²	5.43	5.33	5.28	2.18	3.01	3.01	3.16	3.16	4.15	4.15	4.27	4.27	2.84	2.84	1.03	1.03	2.57
CHEQUEO CAPACIDAD ADMISIBLE	-	O.K.																

DISEÑO ZAPATA - CARGAS MAYORADAS

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
$F_{z,u}$	Ton	10.80	9.63	8.58	8.58	8.55	8.55	7.04	7.04	7.01	7.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peso total mayorado (W_u = $F_{z,u}$+$W_{s,u}$+$W_{z,u}$)	Ton	16.21	14.16	14.15	14.15	14.11	14.11	11.61	11.61	11.58	11.58	4.57	4.57	4.57	4.57	4.57	4.57	4.57
Mx_u	Ton-m	0.17	0.25	0.88	0.88	1.83	1.83	0.78	0.78	1.73	1.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fy_u	Ton	-0.20	-0.29	0.88	0.08	0.50	0.50	0.17	0.17	0.81	0.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My_u	Ton-m	-0.56	-0.49	1.30	1.30	0.49	0.49	1.42	1.42	0.81	0.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fx_u	Ton	-0.22	-0.29	0.84	0.04	0.22	0.22	0.71	0.71	0.28	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'x_u$ = Mx_u+Fy_u*h_z	Ton-m	0.23	0.33	0.88	0.88	1.98	1.98	0.81	0.81	1.92	1.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'y_u$ = My_u+Fx_u*h_z	Ton-m	0.65	0.56	1.50	1.50	0.55	0.55	1.64	1.64	0.89	0.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{xu} = $M'y_u$/W_u	m.	0.04	0.04	0.11	0.11	0.04	0.04	0.14	0.14	0.08	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{yu} = $M'x_u$/W_u	m.	0.01	0.02	0.06	0.06	0.14	0.14	0.07	0.07	0.17	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{xu}/B_x$	-	0.19	0.18	0.49	0.49	0.18	0.18	0.65	0.65	0.36	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{yu}/L_y$	-	0.06	0.11	0.29	0.29	0.65	0.65	0.32	0.32	0.76	0.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$q_{max,u}$ = (W_u/(B_x*L_y))*(1+$6e_{xu}/B_x$+$6e_{yu}/L_y$)	Ton/m²	12.41	10.83	14.88	14.88	15.26	15.26	13.55	13.55	13.87	13.87	2.70	2.70	2.70	2.70	2.70	2.70	2.70
$q_{min,u}$ = (W_u/(B_x*L_y))*(1-$6e_{xu}/B_x$-$6e_{yu}/L_y$)	Ton/m²	7.86	5.96	1.89	1.89	1.42	1.42	0.19	0.19	-0.27	-0.27	2.70	2.70	2.70	2.70	2.70	2.70	2.70
ACCION COMO VIGA																		
DIRECCION X																		
V_u = $q_{max,u}$*L_y*(B_x/2-b/2-d)	Ton	3.83	3.17	4.34	4.34	4.47	4.47	3.96	3.96	4.08	4.08	0.79	0.79	0.79	0.79	0.79	0.79	0.79
v_u = V_u/(L_y*d)	Kg/cm²	1.24	1.08	1.49	1.49	1.53	1.53	1.35	1.35	1.40	1.40	0.27	0.27	0.27	0.27	0.27	0.27	0.27
v_u < ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN X - $v_{u\,max}$	Kg/cm²	1.53																
DIRECCION Y																		
V_u = $q_{max,u}$*B_x*(L_y/2-h/2-d)	Ton	3.02	1.76	2.41	2.41	2.48	2.48	2.20	2.20	2.27	2.27	0.44	0.44	0.44	0.44	0.44	0.44	0.44
v_u = V_u/(B_x*d)	Kg/cm²	0.89	0.60	0.83	0.83	0.85	0.85	0.75	0.75	0.78	0.78	0.15	0.15	0.15	0.15	0.15	0.15	0.15
v_u < ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN Y - $v_{u\,max}$	Kg/cm²	0.89																
ACCION COMO LOSA																		
b_o	cm.	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00
V_u = $q_{max,u}$*(A-(b_c+d)*(h_c+d))	Ton	14.05	12.72	17.44	17.44	17.94	17.94	15.81	15.81	16.41	16.41	3.17	3.17	3.17	3.17	3.17	3.17	3.17
v_u = V_u/(b_o*d)	Kg/cm²	2.22	1.95	2.67	2.67	2.75	2.75	2.44	2.44	2.52	2.52	0.49	0.49	0.49	0.49	0.49	0.49	0.49
v_u < ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO LOSA - $v_{u\,max}$	Kg/cm²	2.75																
DISEÑO A FLEXION EN DOS DIRECCIONES																		
DIRECCION X																		
M_{ux} = $q_{max,u}$*L_y*((B_x-b)/2)²/2	Ton-cm	193.28	205.13	381.01	381.01	402.22	402.22	356.84	356.84	367.87	367.87	71.12	71.12	71.12	71.12	71.12	71.12	71.12
R_u = M_{ux}/(L_y*d²)	Ton/m²	0.00248	0.00460	0.00594	0.00594	0.00611	0.00611	0.00542	0.00542	0.00559	0.00559	0.00108	0.00108	0.00108	0.00108	0.00108	0.00108	0.00108
ρ_x = (0.85*f'_c/f_y)*(1-(1-(2*R_u)/(0.85*f'_c))^0.5) ≥ 0.0018	-	0.00098	0.00117	0.00181	0.00181	0.00195	0.00195	0.00148	0.00148	0.00131	0.00131	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029
A_{sx} = ρ_x*L_y*d	cm²	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27
Longitud de varilla = B_x - 10	cm.	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00
DIRECCION Y																		
M_{uy} = $q_{max,u}$*B_x*((L_y-h)/2)²/2	Ton-cm	167.88	172.48	206.84	206.84	243.33	243.33	218.75	218.75	222.84	222.84	43.03	43.03	43.03	43.03	43.03	43.03	43.03
R_u = M_{uy}/(B_x*d²)	Ton/m²	0.00300	0.00260	0.00359	0.00359	0.00370	0.00370	0.00326	0.00326	0.00336	0.00336	0.00065	0.00065	0.00065	0.00065	0.00065	0.00065	0.00065
ρ_y = (0.85*f'_c/f_y)*(1-(1-(2*R_u)/(0.85*f'_c))^0.5) ≥ 0.0018	-	0.00085	0.00074	0.00102	0.00102	0.00105	0.00105	0.00093	0.00093	0.00096	0.00096	0.00018	0.00018	0.00018	0.00018	0.00018	0.00018	0.00018
A_{sy} = ρ_y*B_x*d	cm²	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27
Longitud de varilla = L_y - 10	cm.	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	5.27
A_{sy} Máximo	cm²	5.27
EN SENTIDO X USAR	-	5 VARILLAS No. 4 L = 1.2 m. @ 30 cm.
EN SENTIDO Y USAR	-	5 VARILLAS No. 4 L = 1.2 m. @ 30 cm.

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE A

ZAPATA CONCENTRICA No. B4

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	= 2.40	Ton/m³	ϕ =	0.85	-
Peso unitario del suelo (γ_s)	= 1.80	Ton/m³	ϕv_c =	15.52	Kg/cm²
Capacidad admisible del suelo (q_{adm})	= 13.00	Ton/m²	α_s =	20.00	-
Profundidad de desplante (D)	= 1.50	m.	d =	22.50	cm.
Área columna (A_c)	= 0.24	m²	b_o =	260.00	cm.
$l_{columna}$ (Sentido X)	= 40.00	cm.	ϕv_c =	11.81	Kg/cm²
$l_{columna}$ (Sentido Y)	= 60.00	cm.	ϕv_c =	13.55	Kg/cm²
β_c	= 1.50	-	ϕv_c (como losa) =	11.81	Kg/cm²
f_y	= 4,200.00	Kg/cm²			
f'_c	= 210.00	Kg/cm²	ϕv_c (como viga) =	6.53	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Ancho zapata en el sentido X (B)	m.	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40
Largo zapata en el sentido Y (L)	m.	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40
B / L	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d_b columna	cm.	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
d_b zapata	cm.	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
l_d	cm.	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
h zapata req.	m.	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
h	m.	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
d zapata	m.	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Área zapata (A)	m²	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
Peso zapata (W_z)	Ton	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41
Peso suelo (W_s)	Ton	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72
Fz	Ton	11.36	11.58	11.52	11.34	11.42	11.42	11.39	11.39	11.57	11.57	11.55	11.55	8.88	8.88	8.85	8.85	0.00
Peso total (W = Fz+Ws+Wz)	Ton	16.49	16.71	16.65	16.48	16.55	16.55	16.52	16.52	16.70	16.70	16.68	16.68	12.00	12.00	11.98	11.98	5.13
Mx	Ton-m	0.95	1.32	1.00	0.21	1.59	1.59	2.35	2.35	1.49	1.49	2.06	2.06	1.21	1.21	1.87	1.87	0.00
Fy	Ton	-0.91	-0.87	-0.86	-0.57	-0.61	-0.61	-0.27	-0.27	-0.74	-0.74	-0.47	-0.47	-0.25	-0.25	0.09	0.09	0.00
My	Ton-m	0.06	-0.06	0.08	-0.07	1.30	1.30	0.73	0.72	1.00	1.00	0.57	0.57	1.29	1.29	0.71	0.71	0.00
Fx	Ton	0.16	-0.19	0.16	0.17	0.81	0.81	0.51	0.51	0.85	0.85	0.42	-0.42	0.74	0.74	0.45	0.45	0.00
M'x = Mx+Fy*h	Ton-m	1.32	1.31	1.26	0.38	1.76	1.76	2.43	2.43	1.71	1.71	2.20	2.20	1.29	1.29	1.94	1.94	0.00
M'y = My+Fx*h	Ton-m	0.11	0.11	0.11	0.13	1.54	1.54	0.88	0.88	1.30	1.30	0.70	0.70	1.50	1.50	0.84	0.84	0.00
e_x = M'y/W	m.	0.01	0.01	0.01	0.01	0.09	0.09	0.05	0.05	0.07	0.07	0.04	0.04	0.13	0.13	0.07	0.07	0.00
e_y = M'x/W	m.	0.07	0.08	0.08	0.02	0.11	0.11	0.15	0.15	0.10	0.10	0.13	0.12	0.11	0.11	0.16	0.16	0.00
$6e_x/B$	-	0.03	0.03	0.03	0.03	0.40	0.40	0.23	0.23	0.31	0.31	0.18	0.18	0.54	0.54	0.30	0.30	0.00
$6e_y/L$	-	0.32	0.34	0.33	0.10	0.46	0.46	0.63	0.63	0.44	0.44	0.57	0.57	0.46	0.46	0.69	0.69	0.00
q_{max}	Ton/m²	11.31	11.61	11.54	8.81	15.70	15.70	16.80	16.80	14.87	14.87	14.08	14.08	12.22	12.22	12.26	12.26	2.62
q_{min}	Ton/m²	5.51	5.43	5.48	7.36	1.10	1.10	1.10	1.10	2.17	2.17	2.17	2.17	0.05	0.05	0.05	0.05	2.62
CHEQUEO CAPACIDAD ADMISIBLE	-	O.K.																

DISEÑO ZAPATA - CARGAS MAYORADAS

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Fz_u	Ton	15.90	13.85	13.86	13.84	12.90	12.90	10.31	10.21	10.27	10.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peso total mayorado (W_u)	Ton	23.08	19.57	19.32	19.32	19.36	19.36	15.69	15.64	15.85	15.85	5.36	5.36	5.36	5.36	5.36	5.36	5.36
Mx_u	Ton-m	1.33	1.25	2.12	2.12	2.21	2.21	1.77	1.77	2.85	2.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fy_u	Ton	-1.27	-1.19	-0.74	-0.74	-0.29	-0.29	-0.40	-0.40	0.09	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My_u	Ton-m	0.08	-0.07	1.85	1.85	1.03	1.03	1.83	1.82	1.01	1.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fx_u	Ton	0.22	-0.19	1.11	1.11	0.69	0.69	1.06	1.06	0.84	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'x_u$	Ton-m	1.71	1.60	2.34	2.34	3.26	3.26	1.89	1.89	2.88	2.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'y_u$	Ton-m	0.15	0.13	2.18	2.18	1.24	1.24	2.15	2.15	1.21	1.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{xu}	m.	0.01	0.01	0.11	0.11	0.06	0.06	0.14	0.14	0.08	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{yu}	m.	0.07	0.08	0.12	0.12	0.17	0.17	0.12	0.12	0.18	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{xu}/B$	-	0.05	0.03	0.48	0.48	0.26	0.26	0.59	0.59	0.33	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{yu}/L$	-	0.32	0.36	0.52	0.52	0.73	0.73	0.52	0.52	0.79	0.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$q_{max,u}$	Ton/m²	15.94	13.67	19.75	19.75	19.72	19.72	16.84	16.84	18.93	18.93	2.75	2.75	2.75	2.75	2.75	2.75	2.75
$q_{min,u}$	Ton/m²	7.71	6.10	-0.04	-0.04	-0.04	-0.04	-0.83	-0.83	-0.96	-0.96	2.75	2.75	2.75	2.75	2.75	2.75	2.75

ACCION COMO VIGA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
V_u	Ton	6.10	5.26	7.93	7.93	7.59	7.59	6.49	6.48	6.52	6.52	1.06	1.06	1.06	1.06	1.06	1.06	1.06
v_u	Kg/cm²	1.94	1.67	2.41	2.41	2.41	2.41	2.06	2.06	2.07	2.07	0.34	0.34	0.34	0.34	0.34	0.34	0.34
$v_u < \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN X - v_{umax}	Kg/cm²	2.41																
DIRECCION Y																		
V_u	Ton	3.98	3.25	4.84	4.84	4.83	4.83	4.13	4.13	4.15	4.15	0.67	0.67	0.67	0.67	0.67	0.67	0.67
v_u	Kg/cm²	1.33	1.06	1.54	1.54	1.53	1.53	1.31	1.31	1.32	1.32	0.21	0.21	0.21	0.21	0.21	0.21	0.21
$v_u < \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN Y - v_{umax}	Kg/cm²	1.54																

ACCION COMO LOSA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
b_o	cm.	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00
V_u	Ton	22.06	19.74	26.53	26.53	26.46	26.46	24.32	24.32	24.46	24.46	3.87	3.87	3.87	3.87	3.87	3.87	3.87
v_u	Kg/cm²	3.51	3.03	4.37	4.37	4.36	4.36	3.73	3.73	3.75	3.75	0.61	0.61	0.61	0.61	0.61	0.61	0.61
$v_u < \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO LOSA - v_{umax}	Kg/cm²	4.37																

DISEÑO A FLEXION EN DOS DIRECCIONES

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
M_u	Ton-cm	377.30	475.20	591.30	591.30	590.12	590.12	509.43	509.43	592.82	592.82	96.13	96.13	96.13	96.13	96.13	96.13	96.13
K	Ton/cm²	0.00691	0.00675	0.00975	0.00975	0.00974	0.00974	0.00832	0.00832	0.00836	0.00836	0.00136	0.00136	0.00136	0.00136	0.00136	0.00136	0.00136
ρ	-	0.00105	0.00183	0.00267	0.00267	0.00267	0.00267	0.00227	0.00227	0.00228	0.00228	0.00036	0.00036	0.00036	0.00036	0.00036	0.00036	0.00036
A_{sx}	cm²	5.67	5.78	8.42	8.42	8.40	8.40	7.14	7.14	7.16	7.16	5.67	5.67	5.67	5.67	5.67	5.67	5.67
Longitud de varilla	cm.	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00
DIRECCION Y																		
M_u	Ton-cm	354.01	306.11	442.43	442.43	441.86	441.86	377.24	377.24	379.29	379.29	61.83	61.83	61.83	61.83	61.83	61.83	61.83
K	Ton/cm²	0.00501	0.00433	0.00624	0.00624	0.00623	0.00623	0.00532	0.00532	0.00535	0.00535	0.00087	0.00087	0.00087	0.00087	0.00087	0.00087	0.00087
ρ	-	0.00143	0.00123	0.00179	0.00179	0.00178	0.00178	0.00152	0.00152	0.00153	0.00153	0.00024	0.00024	0.00024	0.00024	0.00024	0.00024	0.00024
A_{sy}	cm²	5.67	5.78	8.42	8.42	8.40	8.40	7.14	7.14	7.16	7.16	5.67	5.67	5.67	5.67	5.67	5.67	5.67
Longitud de varilla	cm.	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	8.42
A_{sy} Máximo	cm²	8.42
EN SENTIDO X USAR	-	7 VARILLAS No. 4 L = 1.3 m. @ 21.67 cm.
EN SENTIDO Y USAR	-	7 VARILLAS No. 4 L = 1.3 m. @ 21.67 cm.

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE A

ZAPATA CONCENTRICA No. B-4

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	=	2.40	Ton/m³	e =	0.05	-
Peso unitario del suelo (γ_s)	=	1.80	Ton/m³	$\phi v_c = \phi \cdot 0.27 \cdot (2+4/\beta_c) \cdot (f'_c)^{1/2}$ =	15.02	Kg/cm²
Capacidad admisible del suelo (q_{adm})	=	12.00	Ton/m²	α_s =	20.00	-
Profundidad de desplante (D)	=	1.50	m	d =	22.00	cm
Area columnas (A_c)	=	0.24	m²	b_o =	280.00	cm
$b_{columna}$ (Sentido X)	=	40.00	cm	$\phi v_c = \phi \cdot 0.27 \cdot (2+\alpha_s d/b_o) \cdot (f'_c)^{1/2}$ =	11.81	Kg/cm²
$h_{columna}$ (Sentido Y)	=	60.00	cm	$\phi v_c = \phi \cdot 1.1 \cdot (f'_c)^{1/2}$ =	13.56	Kg/cm²
β_c	=	1.50	-			
f_y	=	4,200.00	Kg/cm²	ϕv_c (como losa) =	11.81	Kg/cm²
f'_c	=	210.00	Kg/cm²	$\phi v_c = \phi \cdot 0.53 \cdot (f'_c)^{1/2}$ (como viga) =	6.53	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		COMBINACIONES DE CARGA																
Ancho zapata en el sentido X (B_x)	m	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Largo zapata en el sentido Y (L_y)	m	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
A_{real} / A_{req}	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d_b columna	cm	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
d_b zapata	cm	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
L_d	cm	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
h zapata req. H	m	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58
h	m	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**
d zapata = (h - 0.075)	m	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Area zapata (A)	m²	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25
Peso zapata ($W_z = A \cdot h \cdot \gamma_c$)	Ton	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62
Peso suelo ($W_s = \gamma_s \cdot (A-A_c) \cdot (D-h)$)	Ton	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34
Fz	Ton	12.02	13.06	13.06	13.22	13.25	13.25	13.18	13.18	13.23	13.23	13.17	13.17	8.05	8.05	7.87	7.87	0.00
Peso total ($W_t = F_z+W_s+W_z$)	Ton	18.98	19.02	19.05	19.26	19.22	19.22	19.14	19.14	19.19	19.19	19.14	19.14	14.01	14.01	13.84	13.84	5.96
Mx	Ton-m	0.83	0.83	0.83	0.26	1.94	1.94	3.02	3.02	1.67	1.67	2.49	2.49	1.61	1.61	2.59	2.59	0.00
Fy	Ton	-0.81	-0.82	-0.82	-0.80	-0.29	-0.29	0.21	0.21	-0.42	-0.42	-0.05	-0.05	0.03	0.03	0.53	0.53	0.00
My	Ton-m	0.04	0.04	0.04	0.08	1.12	1.12	0.82	0.82	0.08	0.08	2.49	2.49	1.11	1.11	0.81	0.81	0.00
Fx	Ton	0.15	0.15	0.15	0.16	0.65	0.65	0.41	0.41	0.53	0.53	0.35	0.35	0.59	0.59	0.38	0.38	0.00
$M'x = Mx + Fy \cdot h$	Ton-m	1.07	1.07	1.07	0.44	2.03	2.03	2.96	2.96	1.80	1.80	2.50	2.50	1.60	1.60	2.53	2.53	0.00
$M'y = My + Fx \cdot h$	Ton-m	0.08	0.08	0.08	0.11	1.32	1.32	0.75	0.75	1.02	1.02	0.59	0.59	1.28	1.28	0.71	0.71	0.00
$e_x = M'y/W_t$	m	0.00	0.00	0.00	0.01	0.07	0.07	0.04	0.04	0.05	0.05	0.03	0.03	0.09	0.09	0.05	0.05	0.00
$e_y = M'x/W_t$	m	0.06	0.06	0.06	0.02	0.11	0.11	0.15	0.15	0.09	0.09	0.13	0.13	0.11	0.11	0.18	0.18	0.00
$6e_x/B_x$	-	0.02	0.02	0.02	0.03	0.27	0.27	0.18	0.18	0.21	0.21	0.12	0.12	0.37	0.37	0.20	0.20	0.00
$6e_y/L_y$	-	0.23	0.23	0.23	0.09	0.43	0.43	0.60	0.60	0.38	0.38	0.53	0.53	0.46	0.46	0.73	0.73	0.00
q_{max}	Ton/m²	**10.40**	**10.81**	**10.80**	**8.80**	**14.49**	**14.49**	**18.09**	**18.09**	**13.84**	**13.84**	**12.99**	**12.99**	**11.35**	**11.35**	**11.90**	**11.90**	**2.65**
q_{min}	Ton/m²	**6.50**	**6.40**	**6.40**	**7.80**	**3.59**	**3.59**	**1.95**	**1.95**	**5.52**	**5.52**	**5.03**	**5.03**	**1.10**	**1.10**	**0.45**	**0.45**	**2.65**
CHEQUEO CAPACIDAD ADMISIBLE	-	O.K.																

DISEÑO ZAPATA - CARGAS MAYORADAS

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Fz_u	Ton	16.22	15.69	18.30	18.00	15.90	15.90	12.05	12.05	11.95	11.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peso total mayorado (W_{tu})	Ton	25.57	21.95	22.26	22.26	22.16	22.16	18.01	18.01	18.21	18.21	6.26	6.26	6.26	6.26	6.26	6.26	6.26
Mx_u	Ton-m	1.15	0.88	2.59	2.59	4.12	4.12	2.34	2.34	3.67	3.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fy_u	Ton	-1.13	-0.88	-0.24	-0.24	0.47	0.47	0.01	0.01	0.72	0.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My_u	Ton-m	0.05	0.05	1.59	1.59	0.86	0.86	1.58	1.58	0.67	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fx_u	Ton	0.20	0.18	0.89	0.89	0.56	0.56	0.85	0.85	0.52	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'x_u = Mx_u + Fy_u \cdot h$	Ton-m	1.50	1.28	2.66	2.66	4.26	4.26	2.34	2.34	4.09	4.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'y_u = My_u + Fx_u \cdot h$	Ton-m	0.12	0.10	1.86	1.86	1.05	1.05	1.84	1.84	1.02	1.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$e_{xu} = M'y_u/W_{tu}$	m	0.00	0.00	0.08	0.08	0.05	0.05	0.10	0.10	0.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$e_{yu} = M'x_u/W_{tu}$	m	0.06	0.06	0.12	0.12	0.19	0.19	0.13	0.13	0.22	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{xu}/B_x$	-	0.02	0.02	0.33	0.33	0.19	0.19	0.40	0.40	0.22	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{yu}/L_y$	-	0.23	0.23	0.48	0.48	0.77	0.77	0.51	0.51	0.90	0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00
q_{umax}	Ton/m²	14.68	12.03	17.93	17.93	19.26	19.26	18.57	18.57	17.16	17.16	2.78	2.78	2.78	2.78	2.78	2.78	2.78
q_{umin}	Ton/m²	8.04	7.29	1.85	1.85	0.41	0.41	0.71	0.71	-0.99	-0.99	2.78	2.78	2.78	2.78	2.78	2.78	2.78

ACCION COMO VIGA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
V_u	Ton	7.15	5.88	8.74	8.74	6.45	6.45	7.59	7.59	8.38	8.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38
v_u	Kg/cm²	2.12	1.77	2.58	2.58	2.79	2.79	2.25	2.25	2.48	2.48	0.40	0.40	0.40	0.40	0.40	0.40	0.40
$v_u \le \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN X - v_{umax}	Kg/cm²	2.79																
DIRECCION Y																		
V_u	Ton	4.90	4.12	6.05	6.05	6.51	6.51	5.25	5.25	5.80	5.80	0.94	0.94	0.94	0.94	0.94	0.94	0.94
v_u	Kg/cm²	1.47	1.22	1.79	1.79	1.93	1.93	1.56	1.56	1.72	1.72	0.28	0.28	0.28	0.28	0.28	0.28	0.28
$v_u \le \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN Y - v_{umax}	Kg/cm²	1.93																

ACCION COMO LOSA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
b_o	cm	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00
V_u	Ton	33.45	31.20	31.09	31.09	33.45	33.45	27.00	27.00	29.80	29.80	4.83	4.83	4.83	4.83	4.83	4.83	4.83
v_u	Kg/cm²	3.90	3.25	4.77	4.77	5.13	5.13	4.14	4.14	4.57	4.57	0.74	0.74	0.74	0.74	0.74	0.74	0.74
$v_u \le \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO LOSA - v_{umax}	Kg/cm²	5.13																

DISEÑO A FLEXION EN DOS DIRECCIONES

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
M_u	Ton-cm	**532.84**	**504.50**	**813.47**	**813.47**	**875.19**	**875.19**	**708.33**	**708.33**	**779.60**	**779.60**	**128.24**	**128.24**	**128.24**	**128.24**	**128.24**	**128.24**	**128.24**
K_u	Ton/cm²	0.00408	0.00730	0.01071	0.01071	0.01153	0.01153	0.00930	0.00930	0.01027	0.01027	0.00166	0.00166	0.00166	0.00166	0.00166	0.00166	0.00166
ρ ≥ 0.0018	-	0.00118	0.00196	0.00294	0.00294	0.00318	0.00318	0.00254	0.00254	0.00282	0.00282	0.00044	0.00044	0.00044	0.00044	0.00044	0.00044	0.00044
As_x	cm²	8.08	8.70	9.94	9.94	10.72	10.72	8.59	8.59	9.51	9.51	8.08	8.08	8.08	8.08	8.08	8.08	8.08
Longitud de varilla = B_x - 10	cm	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00
DIRECCION Y																		
M_u	Ton-cm	**446.70**	**371.21**	**844.88**	**844.88**	**886.67**	**886.67**	**472.03**	**472.03**	**821.86**	**821.86**	**84.81**	**84.81**	**84.81**	**84.81**	**84.81**	**84.81**	**84.81**
K_u	Ton/cm²	0.00597	0.00498	0.00717	0.00717	0.00772	0.00772	0.00633	0.00633	0.00687	0.00687	0.00111	0.00111	0.00111	0.00111	0.00111	0.00111	0.00111
ρ ≥ 0.0018	-	0.00196	0.00139	0.00206	0.00206	0.00222	0.00222	0.00179	0.00179	0.00197	0.00197	0.00031	0.00031	0.00031	0.00031	0.00031	0.00031	0.00031
As_y	cm²	8.08	8.70	9.94	9.94	10.72	10.72	8.59	8.59	9.51	9.51	8.08	8.08	8.08	8.08	8.08	8.08	8.08
Longitud de varilla = L_y - 10	cm	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	10.72
A_{sy} Máximo	cm²	10.72
EN SENTIDO X USAR	-	8 VARILLAS No. 4 L = 1.4 m. @ 17.5 cm.
EN SENTIDO Y USAR	-	8 VARILLAS No. 4 L = 1.4 m. @ 17.5 cm.

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE A

ZAPATA CONCENTRICA No. D-1

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	=	2.40	Ton/m³	ϕ =	0.85	-
Peso unitario del suelo (γ_s)	=	1.80	Ton/m³	$v_c = \phi*0.27*(2+4/\beta_c)*(f'_c)^{0.5}$ =	15.52	Kg/cm²
Capacidad admisible del suelo (q_{adm})	=	12.00	Ton/m²	α_s =	20.00	-
Profundidad de desplante (D)	=	1.50	m	d =	22.50	cm
Área columnas (A_c)	=	0.24	m²	b_o =	280.00	cm
$b_{columna}$ (Sentido X)	=	40.00	cm	$v_c = \phi*0.27*(2+\alpha_s*d/b_o)*(f'_c)^{0.5}$ =	11.81	Kg/cm²
$t_{columna}$ (Sentido Y)	=	60.00	cm	$v_c = \phi*1.1*(f'_c)^{0.5}$ =	13.55	Kg/cm²
β_c	=	1.50	-			
f_y	=	4,200.00	Kg/cm²	v_c (como losa) =	11.81	Kg/cm²
f'_c	=	210.00	Kg/cm²	$v_c = \phi*0.53*(f'_c)^{0.5}$ (como viga) =	6.53	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		COMBINACIONES DE CARGA																
Ancho zapata en el sentido X (B_x)	m	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70
Largo zapata en el sentido Y (L_y)	m	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70
B_{req}/L_{req}	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d_b columna	cm	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
d_b zapata	cm	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
l_d	cm	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
h zapata req.	m	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
h	m	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**
d zapata = (h - 0.075)	m	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Área zapata (A)	m²	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89
Peso zapata ($W_z = A*h*\gamma_c$)	Ton	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08
Peso suelo (W_s)	Ton	5.72	5.72	5.72	5.72	5.72	5.72	5.72	5.72	5.72	5.72	5.72	5.72	5.72	5.72	5.72	5.72	5.72
Fz	Ton	4.74	4.89	4.84	5.36	4.99	4.99	4.93	4.93	5.03	5.03	4.99	4.99	3.09	3.09	3.03	3.03	0.00
Peso total (Wt = Fz+Ws+Wz)	Ton	12.54	12.69	12.64	13.16	12.79	12.79	12.73	12.73	12.83	12.83	12.79	12.79	10.90	10.90	10.84	10.84	7.80
Mx	Ton-m	0.44	0.42	0.42	-0.10	1.14	1.14	1.99	1.99	0.96	0.96	1.51	1.51	0.96	0.96	1.70	1.70	0.00
Fy	Ton	-0.42	-0.41	-0.41	-0.34	-0.14	-0.14	0.15	0.15	-0.20	-0.20	0.02	0.02	0.02	0.02	0.32	0.32	0.00
My	Ton-m	0.03	0.03	0.03	0.09	1.24	1.24	1.10	1.10	0.95	0.95	0.84	0.84	1.22	1.22	1.09	1.09	0.00
Fx	Ton	0.14	0.14	0.14	0.17	0.70	0.70	0.64	0.64	0.57	0.57	0.52	0.52	0.65	0.65	0.59	0.59	0.00
MX = Mx+Fy*h	Ton-m	0.57	0.54	0.55	0.01	1.18	1.18	1.83	1.83	1.01	1.01	1.50	1.50	0.95	0.95	1.60	1.60	0.00
MY = My+Fx*h	Ton-m	0.07	0.07	0.07	0.14	1.45	1.45	1.29	1.29	1.12	1.12	1.00	1.00	1.42	1.42	1.27	1.27	0.00
e_x = MY/Wt	m	0.01	0.01	0.01	0.01	0.11	0.11	0.10	0.10	0.09	0.09	0.08	0.08	0.13	0.13	0.12	0.12	0.00
e_y = MX/Wt	m	0.05	0.04	0.04	0.00	0.09	0.09	0.14	0.14	0.08	0.08	0.12	0.12	0.09	0.09	0.15	0.15	0.00
$6e_x/B_x$	-	0.02	0.02	0.02	0.04	0.40	0.40	0.36	0.36	0.31	0.31	0.28	0.28	0.46	0.46	0.41	0.41	0.00
$6e_y/L_y$	-	0.16	0.15	0.15	0.00	0.33	0.33	0.51	0.51	0.28	0.28	0.41	0.41	0.31	0.31	0.52	0.52	0.00
q_{max}	Ton/m²	**5.12**	**5.14**	**5.13**	**4.75**	**7.84**	**7.84**	**8.22**	**8.22**	**7.06**	**7.06**	**7.48**	**7.48**	**6.67**	**6.67**	**7.28**	**7.28**	**2.70**
q_{min}	Ton/m²	**3.56**	**3.64**	**3.62**	**4.36**	**1.21**	**1.21**	**0.59**	**0.59**	**1.84**	**1.84**	**1.27**	**1.27**	**0.87**	**0.87**	**0.26**	**0.26**	**2.70**
CHEQUEO CAPACIDAD ADMISIBLE	-	O.K.																

DISEÑO ZAPATA - CARGAS MAYORADAS

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Fz_u	Ton	6.63	5.81	6.18	6.18	6.13	6.13	4.82	4.82	4.54	4.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peso total mayorado	Ton	17.56	14.13	14.37	14.37	14.29	14.29	12.81	12.81	12.73	12.73	8.20	8.20	8.20	8.20	8.20	8.20	8.20
Mx_u	Ton-m	0.62	0.49	1.50	1.50	2.56	2.56	1.39	1.39	2.45	2.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fy_u	Ton	-0.59	-0.49	-0.09	0.09	0.33	0.33	0.02	0.02	0.44	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My_u	Ton-m	0.04	0.03	1.77	1.77	1.57	1.57	1.76	1.76	1.58	1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fx_u	Ton	0.20	0.17	0.87	0.87	0.69	0.69	0.62	0.62	0.64	0.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$MX_u = Mx_u+Fy_u*h$	Ton-m	0.79	0.64	1.53	1.53	2.65	2.66	1.40	1.40	2.58	2.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$MY_u = My_u+Fx_u*h$	Ton-m	0.10	0.09	2.06	2.06	1.84	1.84	2.04	2.04	1.81	1.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{xu}	m	0.01	0.01	0.14	0.14	0.13	0.13	0.16	0.16	0.14	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{yu}	m	0.05	0.05	0.11	0.11	0.19	0.19	0.11	0.11	0.20	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_x/B_x$	-	0.03	0.03	0.51	0.51	0.46	0.46	0.56	0.56	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_y/L_y$	-	0.18	0.16	0.38	0.38	0.66	0.66	0.39	0.39	0.71	0.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00
q_{umax}	Ton/m²	7.16	5.77	8.36	8.36	10.42	10.42	8.83	8.83	8.77	8.77	2.84	2.84	2.84	2.84	2.84	2.84	2.84
q_{umin}	Ton/m²	4.99	3.99	0.59	0.59	-0.54	-0.54	0.24	0.24	-0.95	-0.95	2.84	2.84	2.84	2.84	2.84	2.84	2.84

ACCION COMO VIGA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
V_u	Ton	5.15	4.17	6.75	6.75	7.50	7.50	6.34	6.34	7.06	7.06	2.05	2.05	2.05	2.05	2.05	2.05	2.05
v_u	Kg/cm²	1.35	1.09	1.77	1.77	1.97	1.97	1.63	1.63	1.85	1.85	0.54	0.54	0.54	0.54	0.54	0.54	0.54
$v_u \le \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN X - v_{umax}	Kg/cm²	1.97																
DIRECCION Y																		
V_u	Ton	3.86	3.19	5.17	5.17	5.76	5.76	4.77	4.77	5.40	5.40	1.57	1.57	1.57	1.57	1.57	1.57	1.57
v_u	Kg/cm²	1.03	0.83	1.35	1.35	1.51	1.51	1.25	1.25	1.41	1.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41
$v_u \le \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN Y - v_{umax}	Kg/cm²	1.51																

ACCION COMO LOSA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
b_o	cm	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00
V_u	Ton	17.01	13.69	22.22	22.22	24.76	24.76	20.49	20.49	23.19	23.19	6.73	6.73	6.73	6.73	6.73	6.73	6.73
v_u	Kg/cm²	2.61	2.10	3.41	3.41	3.79	3.79	3.14	3.14	3.55	3.55	1.03	1.03	1.03	1.03	1.03	1.03	1.03
$v_u \le \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO LOSA - v_{umax}	Kg/cm²	3.79																

DISEÑO A FLEXION EN DOS DIRECCIONES

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
M_{ux}	Ton-cm	**287.27**	**414.15**	**672.22**	**672.22**	**746.02**	**746.02**	**616.95**	**616.95**	**701.84**	**701.84**	**203.07**	**203.07**	**203.07**	**203.07**	**203.07**	**203.07**	**203.07**
K_u	Ton/cm²	0.00286	0.00461	0.00751	0.00751	0.00870	0.00870	0.00720	0.00720	0.00815	0.00815	0.00237	0.00237	0.00237	0.00237	0.00237	0.00237	0.00237
$\rho_x \ge 0.0018$	-	0.00080	0.00150	0.00213	0.00213	0.00258	0.00258	0.00196	0.00196	0.00222	0.00222	0.00063	0.00063	0.00063	0.00063	0.00063	0.00063	0.00063
A_{sx}	cm²	6.89	6.89	8.13	8.13	9.09	9.09	7.48	7.48	8.50	8.50	6.89	6.89	6.89	6.89	6.89	6.89	6.89
Longitud de varilla = B_x - 10	cm	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00
DIRECCION Y																		
M_{uy}	Ton-cm	**355.35**	**296.02**	**481.35**	**481.35**	**536.20**	**536.20**	**443.57**	**443.57**	**502.35**	**502.35**	**145.85**	**145.85**	**145.85**	**145.85**	**145.85**	**145.85**	**145.85**
K_u	Ton/cm²	0.00428	0.00345	0.00559	0.00559	0.00623	0.00623	0.00516	0.00516	0.00584	0.00584	0.00169	0.00169	0.00169	0.00169	0.00169	0.00169	0.00169
$\rho_y \ge 0.0018$	-	0.00120	0.00099	0.00160	0.00160	0.00176	0.00176	0.00147	0.00147	0.00167	0.00167	0.00048	0.00048	0.00048	0.00048	0.00048	0.00048	0.00048
A_{sy}	cm²	6.89	6.89	8.13	8.13	9.09	9.09	7.48	7.48	8.50	8.50	6.89	6.89	6.89	6.89	6.89	6.89	6.89
Longitud de varilla = L_y - 10	cm	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00	160.00

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	**9.09**
A_{sy} Máximo	cm²	**9.09**
EN SENTIDO X USAR	-	**8 VARILLAS No. 4 L = 1.6 m. @ 22.86 cm.**
EN SENTIDO Y USAR	-	**8 VARILLAS No. 4 L = 1.6 m. @ 22.86 cm.**

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE A

ZAPATA CONCENTRICA No. Z-2

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	= 2.40	Ton/m³		β =	0.85	-
Peso unitario del suelo (γ_s)	= 1.80	Ton/m³		ϕv_c = [illegible] =	15.52	Kg/cm²
Capacidad admisible del suelo (q_{adm})	= 12.00	Ton/m²		α_s =	20.00	-
Profundidad de desplante (D)	= 1.50	m		d =	22.50	cm
Area columnas (A_c)	= 0.24	m²		b_o =	290.00	cm
$b_{columna}$ (Sentido X)	= 40.00	cm		ϕv_c = [illegible] =	11.81	Kg/cm²
$h_{columna}$ (Sentido Y)	= 60.00	cm		ϕv = ϕ*1.1*$\sqrt{f'_c}$ =	13.55	Kg/cm²
β_c	= 1.50	-				
f_y	= 4,200.00	Kg/cm²		ϕv_c (acción losa) =	11.81	Kg/cm²
f'_c	= 210.00	Kg/cm²		ϕv_c = ϕ*0.53*$\sqrt{f'_c}$ (acción viga) =	6.53	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		COMBINACIONES DE CARGA																
Ancho zapata en el sentido X (B_x)	m	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Largo zapata en el sentido Y (L_y)	m	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
A_{req} / A_{util}	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d_b columna	cm	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
d_b zapata	cm	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
l_d = [illegible]	cm	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
h zapata req. H = [illegible]	m	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
h_z	m	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**
d zapata = (h_z - 0.075)	m	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Area zapata (A)	m²	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25
Peso zapata (W_z = A*h_z*γ_c)	Ton	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62
Peso suelo (W_s = γ_s*(A-A_c)*(D-h_z))	Ton	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34
P	Ton	6.37	6.65	6.59	7.58	6.47	6.47	6.53	6.53	6.65	6.65	6.69	6.69	3.92	3.92	3.98	3.98	0.00
Peso total (W = P+Wz+Ws)	Ton	12.33	12.61	12.54	13.54	12.43	12.43	12.49	12.49	12.61	12.61	12.65	12.65	9.88	9.88	9.94	9.94	5.96
Mx	Ton-m	0.28	-0.38	-0.38	0.08	0.78	0.78	1.38	1.38	0.67	0.67	1.12	1.12	0.83	0.83	1.23	1.23	0.00
Fy	Ton	-0.28	-0.37	-0.37	-0.47	-0.22	-0.22	0.01	0.01	-0.35	-0.35	-0.07	-0.07	-0.07	-0.07	0.17	0.17	0.00
My	Ton-m	-0.27	-0.37	-0.37	-0.35	1.02	1.02	0.85	0.85	0.88	0.88	0.56	0.56	1.17	1.17	1.01	1.01	0.00
Fx	Ton	-0.21	-0.20	-0.20	-0.17	0.52	0.52	0.43	0.43	0.36	0.36	0.26	0.26	0.60	0.60	0.51	0.51	0.00
Mx' = Mx+Fy*h_z	Ton-m	0.50	0.47	0.47	0.22	0.85	0.85	1.38	1.38	0.74	0.74	1.14	1.14	0.85	0.85	1.18	1.18	0.00
My' = My+Fx*h_z	Ton-m	0.43	0.43	0.43	0.35	1.18	1.18	0.98	0.98	0.79	0.79	0.65	0.65	1.35	1.35	1.18	1.18	0.00
e_x = My'/W	m	0.04	0.03	0.03	0.03	0.09	0.09	0.08	0.08	0.06	0.06	0.05	0.05	0.14	0.14	0.12	0.12	0.00
e_y = Mx'/W	m	0.04	0.04	0.04	0.02	0.07	0.07	0.11	0.11	0.06	0.06	0.09	0.09	0.07	0.07	0.12	0.12	0.00
$6e_x/B_x$	-	0.14	0.14	0.14	0.10	0.38	0.38	0.32	0.32	0.25	0.25	0.20	0.20	0.55	0.55	0.47	0.47	0.00
$6e_y/L_y$	-	0.16	0.15	0.15	0.06	0.27	0.27	0.44	0.44	0.24	0.24	0.36	0.36	0.26	0.26	0.48	0.48	0.00
q_{max} = (W/(B_x*L_y))*(1+$6e_x/B_x$+$6e_y/L_y$)	Ton/m²	**7.13**	**7.20**	**7.18**	**7.04**	**8.12**	**8.12**	**8.75**	**8.75**	**8.22**	**8.22**	**8.01**	**8.01**	**7.96**	**7.96**	**8.88**	**8.88**	**2.65**
q_{min} = (W/(B_x*L_y))*(1-$6e_x/B_x$-$6e_y/L_y$)	Ton/m²	**3.83**	**4.00**	**3.96**	**5.00**	**1.92**	**1.92**	**1.34**	**1.34**	**3.00**	**3.00**	**2.44**	**2.44**	**0.83**	**0.83**	**0.25**	**0.25**	**2.65**
CHEQUEO CAPACIDAD ADMISIBLE	-	O.K.																
DISEÑO ZAPATA - CARGAS MAYORADAS																		
P_u	Ton	8.90	8.08	8.08	8.08	8.14	8.14	5.88	5.88	5.95	5.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peso total mayorado (W_u = P_u+W_{zu}+W_{su})	Ton	17.27	14.34	14.32	14.32	14.40	14.40	12.13	12.13	12.21	12.21	6.26	6.26	6.26	6.26	6.26	6.26	6.26
Mx_u	Ton-m	0.53	0.62	1.01	1.01	1.86	1.86	0.62	0.62	1.77	1.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fy_u	Ton	-0.53	-0.44	-0.22	-0.22	0.12	0.12	-0.12	-0.12	0.22	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My_u	Ton-m	-0.52	-0.44	1.55	1.55	1.32	1.32	1.98	1.98	1.43	1.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fx_u	Ton	-0.29	-0.25	0.78	0.78	0.66	0.66	0.84	0.84	0.73	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mx'_u = Mx_u+Fy_u*h_z	Ton-m	0.69	0.55	1.07	1.21	1.90	1.90	0.95	0.95	1.84	1.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My'_u = My_u+Fx_u*h_z	Ton-m	0.61	0.52	1.74	1.79	1.50	1.50	1.91	1.91	1.64	1.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{xu} = My'_u/W_u	m	0.04	0.04	0.13	0.13	0.11	0.11	0.16	0.16	0.13	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{yu} = Mx'_u/W_u	m	0.04	0.04	0.07	0.07	0.13	0.13	0.08	0.08	0.15	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{xu}/B_x$	-	0.14	0.14	0.50	0.50	0.42	0.42	0.63	0.63	0.54	0.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{yu}/L_y$	-	0.16	0.15	0.30	0.30	0.53	0.53	0.31	0.31	0.60	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$q_{max u}$ = (W_u/(B_x*L_y))*(1+$6e_{xu}/B_x$+$6e_{yu}/L_y$)	Ton/m²	8.89	8.37	11.44	11.44	12.47	12.47	10.49	10.49	11.62	11.62	2.78	2.78	2.78	2.78	2.78	2.78	2.78
$q_{min u}$ = (W_u/(B_x*L_y))*(1-$6e_{xu}/B_x$-$6e_{yu}/L_y$)	Ton/m²	5.36	4.48	1.28	1.28	0.33	0.33	0.30	0.30	-0.77	-0.77	2.78	2.78	2.78	2.78	2.78	2.78	2.78
ACCION COMO VIGA																		
DIRECCION X																		
V_u = $q_{max u}$*L_y*(B_x/2-b/2-d)	Ton	4.87	4.03	5.58	5.58	6.08	6.08	5.11	5.11	5.67	5.67	1.36	1.36	1.36	1.36	1.36	1.36	1.36
v_u = V_u/(L_y*d)	Kg/cm²	1.44	1.19	1.65	1.65	1.80	1.80	1.52	1.52	1.68	1.68	0.40	0.40	0.40	0.40	0.40	0.40	0.40
v_u < ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN X - v_{umax}	Kg/cm²	1.80																
DIRECCION Y																		
V_u = $q_{max u}$*B_x*(L_y/2-h/2-d)	Ton	3.37	2.78	3.88	3.88	4.21	4.21	3.54	3.54	3.92	3.92	0.94	0.94	0.94	0.94	0.94	0.94	0.94
v_u = V_u/(B_x*d)	Kg/cm²	1.00	0.82	1.14	1.14	1.25	1.25	1.05	1.05	1.16	1.16	0.28	0.28	0.28	0.28	0.28	0.28	0.28
v_u < ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN Y - v_{umax}	Kg/cm²	1.25																
ACCION COMO LOSA																		
b_o	cm	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00
V_u = $q_{max u}$*(A - (b+d)*(h+d))	Ton	17.32	14.35	19.85	19.85	21.53	21.53	18.16	18.16	20.16	20.16	4.83	4.83	4.83	4.83	4.83	4.83	4.83
v_u = V_u/(b_o*d)	Kg/cm²	2.65	2.20	3.04	3.04	3.31	3.31	2.79	2.79	3.09	3.09	0.74	0.74	0.74	0.74	0.74	0.74	0.74
v_u < ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO LOSA - v_{umax}	Kg/cm²	3.31																
DISEÑO A FLEXION EN DOS DIRECCIONES																		
DIRECCION X																		
M_{ux} = $q_{max u}$*L_y*((B_x-b)/2)²/2	Ton-cm	**226.90**	**275.30**	**516.31**	**516.31**	**665.09**	**665.09**	**475.94**	**475.94**	**627.42**	**627.42**	**128.24**	**128.24**	**128.24**	**128.24**	**128.24**	**128.24**	**128.24**
K_u = M_{ux}/(L_y*d²)	Ton/cm²	0.00296	0.00464	0.00868	0.00868	0.00745	0.00745	0.00527	0.00527	0.00595	0.00595	0.00188	0.00188	0.00188	0.00188	0.00188	0.00188	0.00188
ρ_x = [illegible] > 0.0018	-	0.00080	0.00133	0.00166	0.00166	0.00203	0.00203	0.00170	0.00170	0.00168	0.00168	0.00044	0.00044	0.00044	0.00044	0.00044	0.00044	0.00044
A_{sx} = ρ_x*L_y*d	cm²	6.08	6.08	6.36	6.36	6.84	6.84	6.08	6.08	6.36	6.36	6.08	6.08	6.08	6.08	6.08	6.08	6.08
Longitud de varilla = B_x - 10	cm	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00
DIRECCION Y																		
M_{uy} = $q_{max u}$*B_x*((L_y-h)/2)²/2	Ton-cm	**303.39**	**251.33**	**347.84**	**347.84**	**376.02**	**376.02**	**318.81**	**318.81**	**353.07**	**353.07**	**84.81**	**84.81**	**84.81**	**84.81**	**84.81**	**84.81**	**84.81**
K_u = M_{uy}/(B_x*d²)	Ton/cm²	0.00400	0.00331	0.00458	0.00458	0.00496	0.00496	0.00420	0.00420	0.00465	0.00465	0.00111	0.00111	0.00111	0.00111	0.00111	0.00111	0.00111
ρ_y = [illegible] > 0.0018	-	0.00113	0.00094	0.00130	0.00130	0.00142	0.00142	0.00119	0.00119	0.00132	0.00132	0.00031	0.00031	0.00031	0.00031	0.00031	0.00031	0.00031
A_{sy} = ρ_y*B_x*d	cm²	6.08	6.08	6.36	6.36	6.84	6.84	6.08	6.08	6.36	6.36	6.08	6.08	6.08	6.08	6.08	6.08	6.08
Longitud de varilla = L_y - 10	cm	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00
REFUERZO REQUERIDO																		
A_{sx} Máximo	cm²	6.84																
A_{sy} Máximo	cm²	6.84																
EN SENTIDO X USAR	-	5 VARILLAS No. 4 L = 1.4 m. @ 28 cm.																
EN SENTIDO Y USAR	-	5 VARILLAS No. 4 L = 1.4 m. @ 28 cm.																

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE A

ZAPATA CONCENTRICA No. [illegible]

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	=	2.40	Ton/m³
Peso unitario del suelo (γ_s)	=	1.80	Ton/m³
Capacidad admisible del suelo (q_{adm})	=	12.00	Ton/m²
Profundidad de desplante (D)	=	1.50	m.
Area columnas (A_c)	=	0.24	m²
(Sentido X)	=	40.00	cm.
(Sentido Y)	=	60.00	cm.
	=	1.50	-
f_y	=	4,200.00	Kg/cm²
f'_c	=	210.00	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DISEÑO ZAPATA - CARGAS MAYORADAS

ACCION COMO VIGA

ACCION COMO LOSA

DISEÑO A FLEXION EN DOS DIRECCIONES

REFUERZO REQUERIDO

EN SENTIDO X USAR	-	[illegible] VARILLAS No. 4 L = 1.4 m. @ 20 cm.
EN SENTIDO Y USAR	-	[illegible] VARILLAS No. 4 L = 1.4 m. @ 20 cm.

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE A

ZAPATA CONCENTRICA No. D4

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	=	2.40	Ton/m³	ϕ =	0.85	-
Peso unitario del suelo (γ_s)	=	1.80	Ton/m³	v_c =	15.52	Kg/cm²
Capacidad admisible del suelo (q_{adm})	=	12.00	Ton/m²	α_s =	20.00	-
Profundidad de desplante (D)	=	1.50	m.	d =	22.50	cm.
Area columnas (A_c)	=	0.24	m²	b_o =	290.00	cm.
$L_{columna}$ (Sentido X)	=	40.00	cm.	v_c =	11.91	Kg/cm²
$L_{columna}$ (Sentido Y)	=	60.00	cm.	v_c =	13.55	Kg/cm²
β_c	=	1.50	-			
f_y	=	4,200.00	Kg/cm²	v_c (como losa) =	11.91	Kg/cm²
f'_c	=	210.00	Kg/cm²	v_c (como viga) =	6.53	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Ancho zapata en el sentido X (B_x)	m.	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75
Largo zapata en el sentido Y (L_y)	m.	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75
Relac. L/B	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
β_c columna	cm.	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
β zapata	cm.	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
l_d	cm.	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
h zapata (m), H = ...	m.	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
h_z	m.	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
d zapata = (h_z - 0.075)	m.	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Area zapata (A)	m²	3.06	3.06	3.06	3.06	3.06	3.06	3.06	3.06	3.06	3.06	3.06	3.06	3.06	3.06	3.06	3.06	3.06
Peso zapata (W_z = A*h_z*γ_c)	Ton	2.21	2.21	2.21	2.21	2.21	2.21	2.21	2.21	2.21	2.21	2.21	2.21	2.21	2.21	2.21	2.21	2.21
Peso suelo (W_s = γ_s*(A-A_c)*(D-h_z))	Ton	6.10	6.10	6.10	6.10	6.10	6.10	6.10	6.10	6.10	6.10	6.10	6.10	6.10	6.10	6.10	6.10	6.10
Fz	Ton	6.58	6.62	6.60	7.15	6.78	6.78	6.71	6.71	6.80	6.80	6.75	6.75	4.18	4.18	4.11	4.11	0.00
Peso total (Wt = Fz+Wz+Ws)	Ton	14.90	14.90	14.90	15.45	15.07	15.07	15.01	15.01	15.10	15.10	15.05	15.05	12.47	12.47	12.41	12.41	8.30
Mx	Ton-m	0.44	0.44	0.44	0.02	1.44	1.44	2.39	2.39	1.26	1.26	1.92	1.92	1.26	1.26	2.22	2.22	0.00
Fy	Ton	-0.47	-0.47	-0.47	-0.39	-0.06	-0.06	0.34	0.34	-0.15	-0.15	0.14	0.14	0.12	0.13	0.52	0.52	0.00
My	Ton-m	0.13	0.13	0.13	0.18	1.35	1.35	1.22	1.22	1.05	1.05	0.96	0.96	1.26	1.26	1.17	1.17	0.00
Fx	Ton	0.23	0.23	0.23	0.25	0.80	0.80	0.75	0.75	0.68	0.68	0.62	0.62	0.70	0.70	0.86	0.86	0.00
M'x = Mx+Fy*h_z	Ton-m	0.58	0.58	0.58	0.14	1.46	1.46	2.29	2.29	1.24	1.24	1.87	1.87	1.22	1.22	2.06	2.06	0.00
M'y = My+Fx*h_z	Ton-m	0.30	0.30	0.30	0.35	1.59	1.59	1.45	1.45	1.35	1.35	1.15	1.15	1.51	1.51	1.37	1.37	0.00
e_x = M'y/W_t	m.	0.01	0.01	0.01	0.02	0.11	0.11	0.10	0.10	0.08	0.08	0.08	0.08	0.12	0.12	0.11	0.11	0.00
e_y = M'x/W_t	m.	0.04	0.04	0.04	0.01	0.10	0.10	0.15	0.15	0.08	0.08	0.12	0.12	0.10	0.10	0.17	0.17	0.00
6e_x/B_x	-	0.05	0.05	0.05	0.08	0.36	0.36	0.33	0.33	0.28	0.28	0.26	0.26	0.41	0.41	0.38	0.38	0.00
6e_y/L_y	-	0.14	0.13	0.13	0.03	0.33	0.33	0.52	0.52	0.28	0.28	0.43	0.43	0.34	0.34	0.57	0.57	0.00
q_{max} = (W_t/(B_x*L_y))*(1+6e_x/B_x+6e_y/L_y)	Ton/m²	8.71	8.74	8.74	8.49	8.83	8.83	9.06	9.06	7.72	7.72	8.50	8.50	7.12	7.12	7.09	7.09	2.71
q_{min} = (W_t/(B_x*L_y))*(1-6e_x/B_x-6e_y/L_y)	Ton/m²	3.98	4.01	3.98	4.81	1.51	1.51	0.71	0.71	3.14	3.14	1.83	1.83	1.81	1.81	0.21	0.21	2.71
CHEQUEO CAPACIDAD ADMISIBLE	-	O.K.																

DISEÑO ZAPATA - CARGAS MAYORADAS

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Fz_u	Ton	9.10	8.80	8.30	8.30	8.22	8.22	8.23	8.23	8.14	8.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peso total mayorado (W_{tu} = Fz_u+W_{zu}+W_{su})	Ton	20.72	18.72	17.02	17.02	15.84	15.84	14.94	14.94	14.86	14.86	8.72	8.72	8.72	8.72	8.72	8.72	8.72
Mx_u	Ton-m	0.62	-0.52	1.90	1.90	2.27	2.27	1.82	1.82	2.19	2.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fy_u	Ton	-0.65	-0.56	0.00	0.02	0.58	0.58	0.17	0.17	0.73	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My_u	Ton-m	0.18	0.15	1.90	1.90	1.72	1.72	1.88	1.88	1.88	1.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fx_u	Ton	0.23	0.28	1.09	1.09	1.02	1.00	1.02	1.02	0.95	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'x_u$ = Mx_u+Fy_u*h_z	Ton-m	0.30	0.09	1.90	1.98	3.48	3.48	1.67	1.67	3.40	3.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'y_u$ = My_u+Fx_u*h_z	Ton-m	0.28	0.24	2.22	2.22	2.02	2.02	2.16	2.16	1.98	1.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{xu} = M'y_u/W_{tu}	m.	0.01	0.01	0.13	0.13	0.13	0.13	0.14	0.14	0.13	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{yu} = M'x_u/W_{tu}	m.	0.04	0.00	0.12	0.12	0.21	0.21	0.13	0.13	0.23	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6e_{xu}/B_x	-	0.05	0.05	0.45	0.45	0.41	0.41	0.50	0.50	0.45	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6e_{yu}/L_y	-	0.14	0.14	0.38	0.38	0.71	0.71	0.43	0.43	0.79	0.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00
q_{maxu} = (W_{tu}/(B_x*L_y))*(1+6e_{xu}/B_x+6e_{yu}/L_y)	Ton/m²	7.89	6.52	10.24	10.24	11.76	11.76	9.42	9.42	13.98	13.98	2.85	2.85	2.85	2.85	2.85	2.85	2.85
q_{minu} = (W_{tu}/(B_x*L_y))*(1-6e_{xu}/B_x-6e_{yu}/L_y)	Ton/m²	5.54	4.62	0.88	0.88	-0.64	-0.64	0.38	0.38	-1.18	-1.18	2.85	2.85	2.85	2.85	2.85	2.85	2.85

ACCION COMO VIGA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
V_u = q_{maxu}*L_y*((B_x-b_c)/2-d)	Ton	6.29	5.13	8.08	8.08	9.21	9.21	7.40	7.40	8.55	8.55	2.24	2.24	2.24	2.24	2.24	2.24	2.24
v_u = V_u/(ϕ*b*d)	Kg/cm²	1.60	1.30	2.05	2.05	2.34	2.34	1.88	1.88	2.17	2.17	0.57	0.57	0.57	0.57	0.57	0.57	0.57
v_u < ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN X - V_{umax}	Kg/cm²	2.34																
DIRECCION Y																		
V_u = q_{maxu}*B_x*((L_y-l_c)/2-d)	Ton	4.90	3.98	6.27	6.27	7.17	7.17	5.78	5.78	6.85	6.85	1.74	1.74	1.74	1.74	1.74	1.74	1.74
v_u = V_u/(ϕ*b*d)	Kg/cm²	1.24	1.01	1.59	1.59	1.82	1.82	1.46	1.46	1.69	1.69	0.44	0.44	0.44	0.44	0.44	0.44	0.44
v_u < ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN Y - V_{umax}	Kg/cm²	1.82																

ACCION COMO LOSA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
b_o	cm.	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00
V_u = q_{maxu}*(A - (b_c+d)*(l_c+d))	Ton	20.36	16.56	26.07	26.07	29.80	29.80	23.60	23.60	27.86	27.86	7.25	7.25	7.25	7.25	7.25	7.25	7.25
v_u = V_u/(b_o*d)	Kg/cm²	3.12	2.54	4.00	4.00	4.57	4.57	3.67	3.67	4.24	4.24	1.11	1.11	1.11	1.11	1.11	1.11	1.11
v_u < ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO LOSA - V_{umax}	Kg/cm²	4.57																

DISEÑO A FLEXION EN DOS DIRECCIONES

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
M_{ux} = q_{maxu}*L_y*((B_x-b_c)/2)²/2	Ton-cm	518.80	610.29	916.12	916.12	923.06	923.06	749.39	749.39	999.03	999.03	220.84	220.84	220.84	220.84	220.84	220.84	220.84
K_u = M_{ux}/(L_y*d²)	Ton/cm²	0.00565	0.00595	0.00921	0.00921	0.01053	0.01053	0.00848	0.00848	0.00978	0.00978	0.00256	0.00256	0.00256	0.00256	0.00256	0.00256	0.00256
ρ = (0.85*f'_c/f_y)*(1-(1-(2*K_u)/(0.85*f'_c))$^{0.5}$) ≥ 0.0018	-	0.00097	0.00158	0.00250	0.00250	0.00289	0.00289	0.00231	0.00231	0.00268	0.00268	0.00069	0.00069	0.00069	0.00069	0.00069	0.00069	0.00069
A_{sx} = ρ*L_y*d	cm²	7.09	7.09	9.60	9.60	11.39	11.39	9.08	9.08	10.55	10.55	7.09	7.09	7.09	7.09	7.09	7.09	7.09
Longitud de varilla = B_x - 10	cm.	165.00	165.00	165.00	165.00	165.00	165.00	165.00	165.00	165.00	165.00	165.00	165.00	165.00	165.00	165.00	165.00	165.00
DIRECCION Y																		
M_{uy} = q_{maxu}*B_x*((L_y-l_c)/2)²/2	Ton-cm	482.90	378.10	590.22	590.22	676.93	676.93	540.72	540.72	620.43	620.43	164.80	164.80	164.80	164.80	164.80	164.80	164.80
K_u = M_{uy}/(B_x*d²)	Ton/cm²	0.00522	0.00425	0.00666	0.00666	0.00764	0.00764	0.00614	0.00614	0.00706	0.00706	0.00186	0.00186	0.00186	0.00186	0.00186	0.00186	0.00186
ρ = (0.85*f'_c/f_y)*(1-(1-(2*K_u)/(0.85*f'_c))$^{0.5}$) ≥ 0.0018	-	0.00149	0.00121	0.00190	0.00190	0.00220	0.00220	0.00176	0.00176	0.00204	0.00204	0.00052	0.00052	0.00052	0.00052	0.00052	0.00052	0.00052
A_{sy} = ρ*B_x*d	cm²	7.09	7.09	9.60	9.60	11.39	11.39	9.08	9.08	10.55	10.55	7.09	7.09	7.09	7.09	7.09	7.09	7.09
Longitud de varilla = L_y - 10	cm.	165.00	165.00	165.00	165.00	165.00	165.00	165.00	165.00	165.00	165.00	165.00	165.00	165.00	165.00	165.00	165.00	165.00

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	11.39
A_{sy} Máximo	cm²	11.39
EN SENTIDO X USAR	-	9 VARILLAS No. 4 L = 1.65 m. @ 20.00 cm.
EN SENTIDO Y USAR	-	9 VARILLAS No. 4 L = 1.65 m. @ 20.00 cm.

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE A

ZAPATA CONCENTRICA No. B-1

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	=	2.40	Ton/m³	φ =	0.85	-
Peso unitario del suelo (γ_s)	=	1.80	Ton/m³	$v_c = \phi 0.27(2+4/\beta_c)f'_c{}^{1/2}$ =	15.52	Kg/cm²
Capacidad admisible del suelo (q_{adm})	=	12.00	Ton/m²	α_s =	30.00	-
Profundidad de desplante (D)	=	1.50	m.	d =	22.50	cm.
Area columnas (A_c)	=	0.24	m²	b_o =	290.00	cm.
b_{column} (Sentido X)	=	40.00	cm.	$v_c = \phi 0.27(2+\alpha_s d/b_o)f'_c{}^{1/2}$ =	11.01	Kg/cm²
h_{column} (Sentido Y)	=	60.00	cm.	$v_c = \phi 1.1 f'_c{}^{1/2}$ =	13.55	Kg/cm²
β_c	=	1.50	-			
f_y	=	4,200.00	Kg/cm²	v_c (como losa) =	11.01	Kg/cm²
f'_c	=	210.00	Kg/cm²	$v_c = \phi 0.53 f'_c{}^{1/2}$ (como viga) =	6.53	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		COMBINACIONES DE CARGA																
Ancho zapata en el sentido X (B_x)	m.	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Largo zapata en el sentido Y (L_y)	m.	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
B_{xxx} / B_{yxx}	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d_b columna	cm.	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
d_b zapata	cm.	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
l_d = 0.075·fy·db/f'c^½ ... > 0.0043·fy·db	cm.	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
H zapata req. H = [ld+dbzapata+2*dbzapata+7.50]/100	m.	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
H_z	m.	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**
d zapata = (H_z - 0.075)	m.	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Area zapata (A)	m²	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50
Peso zapata (W_z = A·H_z·γ_c)	Ton	16.20	16.20	16.20	16.20	16.20	16.20	16.20	16.20	16.20	16.20	16.20	16.20	16.20	16.20	16.20	16.20	16.20
Peso suelo (W_s = γ_s·(A-A_c)·(D-H_z))	Ton	48.08	48.08	48.08	48.08	48.08	48.08	48.08	48.08	48.08	48.08	48.08	48.08	48.08	48.08	48.08	48.08	48.08
Fy	Ton	4.25	4.40	4.38	3.62	4.54	4.54	4.59	4.59	4.58	4.58	4.82	4.82	2.84	2.84	2.89	2.89	0.00
Peso total (W_t = Fz+Wz+Ws)	Ton	68.52	68.68	68.64	67.91	68.82	68.82	68.87	68.87	68.87	68.87	68.90	68.90	67.12	67.12	67.17	67.17	64.28
Mx	Ton-m	-0.15	-0.15	-0.16	-0.04	0.58	0.58	1.35	1.35	0.40	0.40	0.86	0.86	0.84	0.84	1.41	1.41	0.00
Fy	Ton	0.15	0.11	0.11	0.32	0.42	0.42	0.75	0.75	0.34	0.34	0.59	0.59	0.38	0.38	0.70	0.70	0.00
My	Ton-m	0.09	0.08	0.08	0.02	1.32	1.32	0.95	0.95	1.02	1.02	0.74	0.74	1.29	1.29	0.92	0.92	0.00
Fx	Ton	0.17	0.17	0.17	0.14	0.75	0.75	0.58	0.58	0.61	0.61	0.48	0.48	0.68	0.68	0.51	0.51	0.00
Mfx = Mx+Fy·H_z	Ton-m	0.18	0.19	0.19	0.04	0.45	0.45	1.13	1.13	0.39	0.39	0.80	0.80	0.53	0.53	1.30	1.30	0.00
Mfy = My+Fx·H_z	Ton-m	0.13	0.13	0.13	0.06	1.56	1.56	1.13	1.13	1.30	1.30	0.88	0.88	1.49	1.49	1.07	1.07	0.00
e_x = Mfy/W_t	m.	0.00	0.00	0.00	0.00	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.02	0.02	0.02	0.00
e_y = Mfx/W_t	m.	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.00
6e_x/B_x	-	0.01	0.01	0.01	0.00	0.09	0.09	0.07	0.07	0.07	0.07	0.05	0.05	0.09	0.09	0.06	0.06	0.00
6e_y/L_y	-	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00
q_{max} = (W_t/B_x·L_y)·(1+6ex/Bx+6ey/Ly)	Ton/m²	**3.07**	**3.08**	**3.08**	**3.06**	**3.34**	**3.34**	**3.28**	**3.28**	**3.28**	**3.28**	**3.23**	**3.23**	**3.36**	**3.36**	**3.30**	**3.30**	**2.86**
q_{min} = (W_t/B_x·L_y)·(1-6ex/Bx-6ey/Ly)	Ton/m²	**3.03**	**3.03**	**3.03**	**2.98**	**2.78**	**2.78**	**2.84**	**2.84**	**2.84**	**2.84**	**2.89**	**2.89**	**2.71**	**2.71**	**2.77**	**2.77**	**2.86**
CHEQUEO CAPACIDAD ADMISIBLE	-	O.K.																

DISEÑO ZAPATA - CARGAS MAYORADAS

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Fz_u	Ton	5.95	5.38	5.67	5.67	5.74	5.74	4.24	4.24	4.21	4.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peso total mayorado (W_{tu} = Fz_u+W_{zu}+W_{su})	Ton	85.96	72.64	73.16	73.16	73.23	73.23	71.74	71.74	71.81	71.81	67.50	67.50	67.50	67.50	67.50	67.50	67.50
Mx_u	Ton-m	-0.27	-0.20	0.65	0.65	1.95	1.95	0.91	0.91	2.01	2.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fy_u	Ton	0.15	0.12	0.37	0.37	1.04	1.04	0.54	0.54	1.01	1.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My_u	Ton-m	0.11	0.10	1.97	1.97	1.34	1.34	1.85	1.85	1.21	1.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fx_u	Ton	0.24	0.21	1.03	1.03	0.78	0.78	0.87	0.87	0.73	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mfx_u = Mx_u+Fy_u·H_z	Ton-m	0.25	0.24	1.02	1.02	2.27	2.27	1.07	1.07	2.31	2.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mfy_u = My_u+Fx_u·H_z	Ton-m	0.19	0.18	2.18	2.18	1.57	1.57	2.14	2.14	1.58	1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{xu} = Mfy_u/W_{tu}	m.	0.00	0.00	0.03	0.03	0.02	0.02	0.03	0.03	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{yu} = Mfx_u/W_{tu}	m.	0.00	0.00	0.01	0.01	0.03	0.03	0.01	0.01	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6e_{xu}/B_x	-	0.01	0.01	0.12	0.12	0.09	0.09	0.12	0.12	0.09	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6e_{yu}/L_y	-	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
q_{maxu} = (W_{tu}/B_x·L_y)·(1+6exu/Bx+6eyu/Ly)	Ton/m²	4.30	3.27	3.66	3.66	3.57	3.57	3.56	3.56	3.50	3.50	3.00	3.00	3.00	3.00	3.00	3.00	3.00
q_{minu} = (W_{tu}/B_x·L_y)·(1-6exu/Bx-6eyu/Ly)	Ton/m²	4.23	3.20	2.85	2.85	2.94	2.94	2.79	2.79	2.88	2.88	3.00	3.00	3.00	3.00	3.00	3.00	3.00

ACCION COMO VIGA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
V_u = q_{maxu}·L_y·((B_x-b)/2-d)	Ton	20.97	15.94	17.83	17.83	17.43	17.43	17.49	17.49	17.09	17.09	14.82	14.82	14.82	14.82	14.82	14.82	14.82
v_u = V_u/(L_y·d)	Kg/cm²	0.63	0.47	0.53	0.53	0.52	0.52	0.52	0.52	0.51	0.51	0.43	0.43	0.43	0.43	0.43	0.43	0.43
v_u < v_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN X - v_{umax}	Kg/cm²	0.62																
DIRECCION Y																		
V_u = q_{maxu}·B_x·((L_y-h)/2-d)	Ton	45.01	34.21	38.28	38.28	37.40	37.40	37.53	37.53	36.67	36.67	31.39	31.39	31.39	31.39	31.39	31.39	31.39
v_u = V_u/(B_x·d)	Kg/cm²	13.34	10.14	11.34	11.34	11.08	11.08	11.12	11.12	10.86	10.86	9.30	9.30	9.30	9.30	9.30	9.30	9.30
v_u < v_c	Kg/cm²	CHK		CHK	CHK	CHK	CHK	CHK	CHK	CHK	CHK	CHK	CHK	CHK	CHK	CHK	CHK	CHK
CHEQUEO ACCION COMO VIGA EN Y - v_{umax}	Kg/cm²	13.34																

ACCION COMO LOSA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
b_o	cm.	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00
V_u = q_{maxu}·(A-(b+d)·(h+d))	Ton	84.58	71.88	80.40	80.40	78.58	78.58	78.87	78.87	77.05	77.05	65.95	65.95	65.95	65.95	65.95	65.95	65.95
v_u = V_u/(b_o·d)	Kg/cm²	14.49	11.02	12.33	12.33	12.04	12.04	12.09	12.09	11.81	11.81	10.11	10.11	10.11	10.11	10.11	10.11	10.11
v_u < v_c	Kg/cm²	CHK	O.K.	NO	NO	NO	NO	NO	NO	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO LOSA - v_{umax}	Kg/cm²	14.49																

DISEÑO A FLEXION EN DOS DIRECCIONES

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
M_{ux} = q_{maxu}·L_y·((B_x-b)/2)²/2	Ton-cm	**975.22**	**1,493.00**	**1,659.37**	**1,659.37**	**1,621.00**	**1,621.00**	**1,627.79**	**1,627.79**	**1,595.21**	**1,595.21**	**1,381.16**	**1,381.16**	**1,381.16**	**1,381.16**	**1,381.16**	**1,381.16**	**1,381.16**
K_x = M_{ux}/(L_y·d²)	Ton/m²	0.00129	0.00195	0.00218	0.00218	0.00214	0.00214	0.00214	0.00214	0.00209	0.00209	0.00179	0.00179	0.00179	0.00179	0.00179	0.00179	0.00179
ρ_x = 0.85·f'c/fy·(1-(1-(2.622·Kx/f'c))^½) > 0.0018	-	0.00034	0.00052	0.00058	0.00058	0.00057	0.00057	0.00057	0.00057	0.00056	0.00056	0.00048	0.00048	0.00048	0.00048	0.00048	0.00048	0.00048
A_{sx} = ρ_x·L_y·d	cm²	60.75	60.75	60.75	60.75	60.75	60.75	60.75	60.75	60.75	60.75	60.75	60.75	60.75	60.75	60.75	60.75	60.75
Longitud de varilla = B_x - 10	cm.	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00
DIRECCION Y																		
M_{uy} = q_{maxu}·B_x·((L_y-h)/2)²/2	Ton-cm	**33,482.84**	**28,428.16**	**28,436.82**	**28,436.82**	**27,794.01**	**27,794.01**	**27,090.82**	**27,090.82**	**27,283.81**	**27,283.81**	**23,328.81**	**23,328.81**	**23,328.81**	**23,328.81**	**23,328.81**	**23,328.81**	**23,328.81**
K_y = M_{uy}/(B_x·d²)	Ton/m²	0.44052	0.33863	0.37448	0.37448	0.36603	0.36603	0.35735	0.35735	0.35884	0.35884	0.30718	0.30718	0.30718	0.30718	0.30718	0.30718	0.30718
ρ_y = 0.85·f'c/fy·(1-(1-(2.622·Ky/f'c))^½) > 0.0018	-	#¡NUM!	#¡NUM!	#¡NUM!	#¡NUM!	#¡NUM!	#¡NUM!	#¡NUM!	#¡NUM!	#¡NUM!	#¡NUM!	#¡NUM!	#¡NUM!	#¡NUM!	#¡NUM!	#¡NUM!	#¡NUM!	#¡NUM!
A_{sy} = ρ_y·B_x·d	cm²	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08
Longitud de varilla = L_y - 10	cm.	1,490.00	1,490.00	1,490.00	1,490.00	1,490.00	1,490.00	1,490.00	1,490.00	1,490.00	1,490.00	1,490.00	1,490.00	1,490.00	1,490.00	1,490.00	1,490.00	1,490.00

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	60.75
A_{sy} Máximo	cm²	6.08
EN SENTIDO X USAR	-	48 VARILLAS No. 4 L = 1.4 m. @ 31.7 cm.
EN SENTIDO Y USAR	-	5 VARILLAS No. 4 L = 14.9 m. @ 35 cm.

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE A

ZAPATA CONCENTRICA No. Z-2

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	=	2.40	Ton/m³	ϕ =	0.85	-
Peso unitario del suelo (γ_s)	=	1.80	Ton/m³	ϕv_c = [illegible] =	15.52	Kg/cm²
Capacidad admisible del suelo (q_{adm})	=	12.00	Ton/m²	α_s =	20.00	-
Profundidad de desplante (D)	=	1.50	m	d =	22.50	cm
Área columnas (A_c)	=	0.24	m²	b_o =	280.00	cm
$b_{columna}$ (Sentido X)	=	40.00	cm	ϕv_c = [illegible] =	11.81	Kg/cm²
$t_{columna}$ (Sentido Y)	=	60.00	cm	$\phi v_c = \phi*1.1*f'_c{}^{0.5}$ =	13.55	Kg/cm²
β_c	=	1.50	-			
f_y	=	4,200.00	Kg/cm²	ϕv_c (como losa) =	11.81	Kg/cm²
f'_c	=	210.00	Kg/cm²	$\phi v_c = \phi*0.53*f'_c{}^{0.5}$ (como viga) =	6.53	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	COMBINACIONES DE CARGA																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Ancho zapata en el sentido X (B_x)	m	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30
Largo zapata en el sentido Y (L_y)	m	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30
[illegible]	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
[illegible] columna	cm	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
[illegible] zapata	cm	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
[illegible]	cm	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
h zapata (m) H = [illegible]	m	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58
h_z	m	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**
d zapata = (h_z - 0.075)	m	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Área zapata (A)	m²	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69
Peso zapata (W_z = A*h_z*γ_c)	Ton	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
Peso suelo (W_s = γ_s*(A-A_c)*(D-h_z))	Ton	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13
Fz	Ton	5.70	5.89	5.92	4.47	5.85	5.85	5.96	5.96	6.03	6.03	6.12	6.12	3.57	3.57	3.70	3.70	0.00
Peso total (Wt = Fz+Ws+Wz)	Ton	10.05	10.24	10.27	8.82	10.20	10.20	10.33	10.33	10.38	10.38	10.48	10.48	7.92	7.92	8.05	8.05	4.35
Mx	Ton-m	-0.15	-0.15	-0.15	-0.69	0.28	0.28	0.91	0.91	0.17	0.17	0.85	0.85	0.34	0.34	0.67	0.67	0.00
Fy	Ton	0.09	0.06	0.06	0.21	0.27	0.27	0.54	0.54	0.22	0.22	0.42	0.42	0.22	0.23	0.50	0.50	0.00
My	Ton-m	-0.28	-0.28	-0.28	-0.44	1.06	1.06	0.62	0.62	0.71	0.71	0.38	0.38	1.21	1.21	0.77	0.77	0.00
Fx	Ton	-0.23	-0.23	-0.22	-0.26	0.51	0.51	0.29	0.29	0.33	0.33	0.16	0.16	0.60	0.60	0.35	0.35	0.00
Mx' = Mx+Fy*h_z	Ton-m	0.18	0.18	0.18	0.76	0.19	0.19	0.75	0.75	0.11	0.11	0.52	0.52	0.27	0.27	0.82	0.82	0.00
My' = My+Fx*h_z	Ton-m	0.45	0.45	0.45	0.83	1.21	1.21	0.71	0.71	0.81	0.81	0.43	0.43	1.39	1.39	0.89	0.89	0.00
e_x = My'/Wt	m	0.04	0.04	0.04	0.08	0.12	0.12	0.07	0.07	0.08	0.08	0.04	0.04	0.18	0.18	0.11	0.11	0.00
e_y = Mx'/Wt	m	0.02	0.02	0.00	0.09	0.02	0.02	0.07	0.07	0.01	0.01	0.05	0.05	0.03	0.03	0.10	0.10	0.00
6e_x/B_x	-	0.21	0.20	0.20	0.37	0.55	0.55	0.32	0.32	0.36	0.36	0.19	0.19	0.81	0.81	0.51	0.51	0.00
6e_y/L_y	-	0.08	0.08	0.08	0.40	0.09	0.09	0.33	0.33	0.05	0.05	0.23	0.23	0.15	0.15	0.47	0.47	0.00
q_{max} = [illegible]	Ton/m²	**7.80**	**7.82**	**7.78**	**6.73**	**8.87**	**8.87**	**10.08**	**10.08**	**8.84**	**8.84**	**8.80**	**8.80**	**8.21**	**8.21**	**8.42**	**8.42**	**2.57**
q_{min} = [illegible]	Ton/m²	**4.24**	**4.41**	**4.37**	**1.72**	**3.20**	**3.20**	**2.15**	**2.15**	**3.84**	**3.84**	**3.80**	**3.80**	**0.17**	**0.17**	**0.11**	**0.11**	**2.57**
CHEQUEO CAPACIDAD ADMISIBLE	-	O.K.																

DISEÑO ZAPATA - CARGAS MAYORADAS

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Fz_u	Ton	7.98	7.30	7.34	7.94	7.53	7.53	5.35	5.35	5.54	5.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peso total mayorado (W_{tu} = [illegible])	Ton	14.07	11.67	11.91	11.91	12.10	12.10	9.91	9.91	10.10	10.10	4.57	4.57	4.57	4.57	4.57	4.57	4.57
Mx_u	Ton-m	-0.21	-0.18	0.42	0.42	1.30	1.30	0.47	0.47	1.28	1.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fy_u	Ton	0.13	0.09	0.36	0.36	0.74	0.74	0.34	0.34	0.72	0.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My_u	Ton-m	-0.53	-0.48	1.60	1.60	0.97	0.97	1.71	1.71	1.09	1.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fx_u	Ton	-0.32	-0.26	0.78	0.78	0.46	0.46	0.85	0.85	0.53	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mx_u' = Mx_u+Fy_u*h_z	Ton-m	0.25	0.21	0.53	0.53	1.50	1.50	0.57	0.57	1.59	1.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My_u' = My_u+Fx_u*h_z	Ton-m	0.60	0.54	1.83	1.83	1.11	1.11	1.97	1.97	1.25	1.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{xu} = My_u'/W_{tu}	m	0.04	0.05	0.15	0.15	0.09	0.09	0.20	0.20	0.12	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{yu} = Mx_u'/W_{tu}	m	0.02	0.02	0.04	0.04	0.13	0.13	0.06	0.06	0.16	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6e_{xu}/B_x	-	0.21	0.21	0.71	0.71	0.42	0.42	0.90	0.90	0.57	0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6e_{yu}/L_y	-	0.08	0.08	0.21	0.21	0.59	0.59	0.27	0.27	0.73	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$q_{max u}$ = [illegible]	Ton/m²	10.71	8.07	12.50	12.50	14.42	14.42	12.60	12.60	13.73	13.73	2.70	2.70	2.70	2.70	2.70	2.70	2.70
$q_{min u}$ = [illegible]	Ton/m²	5.94	4.98	0.58	0.58	-0.11	-0.11	-1.07	-1.07	-1.77	-1.77	2.70	2.70	2.70	2.70	2.70	2.70	2.70

ACCION COMO VIGA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
V_u = [illegible]	Ton	3.13	2.65	3.86	3.86	4.22	4.22	3.75	3.75	4.03	4.03	0.79	0.79	0.79	0.79	0.79	0.79	0.79
v_u = [illegible]	Kg/cm²	1.07	0.91	1.38	1.38	1.46	1.46	1.28	1.28	1.37	1.37	0.27	0.27	0.27	0.27	0.27	0.27	0.27
$v_u \le \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN X - V_{umax}	Kg/cm²	**1.44**																
DIRECCION Y																		
V_u = [illegible]	Ton	1.74	1.47	2.19	2.19	2.34	2.34	2.08	2.08	2.23	2.23	0.44	0.44	0.44	0.44	0.44	0.44	0.44
v_u = [illegible]	Kg/cm²	0.60	0.52	0.75	0.75	0.80	0.80	0.71	0.71	0.76	0.76	0.15	0.15	0.15	0.15	0.15	0.15	0.15
$v_u \le \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN Y - V_{umax}	Kg/cm²	**0.80**																

ACCION COMO LOSA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
b_o	cm	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00
V_u = [illegible]	Ton	12.58	10.65	15.88	15.88	16.94	16.94	15.04	15.04	16.12	16.12	3.17	3.17	3.17	3.17	3.17	3.17	3.17
v_u = [illegible]	Kg/cm²	1.93	1.63	2.43	2.43	2.60	2.60	2.30	2.30	2.47	2.47	0.49	0.49	0.49	0.49	0.49	0.49	0.49
$v_u \le \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO LOSA - V_{umax}	Kg/cm²	**2.60**																

DISEÑO A FLEXION EN DOS DIRECCIONES

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
M_{ux} = [illegible]	Ton-cm	**141.03**	**226.77**	**368.43**	**368.43**	**376.74**	**376.74**	**337.07**	**337.07**	**361.39**	**361.39**	**71.13**	**71.13**	**71.13**	**71.13**	**71.13**	**71.13**	**71.13**
K_u = [illegible]	Ton/cm²	0.00214	0.00363	0.00560	0.00560	0.00577	0.00577	0.00512	0.00512	0.00549	0.00549	0.00108	0.00108	0.00108	0.00108	0.00108	0.00108	0.00108
ρ_x = [illegible] ≥ 0.0018	-	0.00057	0.00097	0.00148	0.00148	0.00156	0.00156	0.00138	0.00138	0.00148	0.00148	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029
A_{sx} = [illegible]	cm²	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27
Longitud de varilla = B_x - 10	cm	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00
DIRECCION Y																		
M_{uy} = [illegible]	Ton-cm	**170.80**	**144.44**	**218.01**	**218.01**	**226.73**	**226.73**	**205.81**	**205.81**	**218.82**	**218.82**	**43.03**	**43.03**	**43.03**	**43.03**	**43.03**	**43.03**	**43.03**
K_u = [illegible]	Ton/cm²	0.00259	0.00219	0.00327	0.00327	0.00344	0.00344	0.00310	0.00310	0.00332	0.00332	0.00065	0.00065	0.00065	0.00065	0.00065	0.00065	0.00065
ρ_y = [illegible] ≥ 0.0018	-	0.00073	0.00062	0.00090	0.00090	0.00096	0.00096	0.00088	0.00088	0.00094	0.00094	0.00018	0.00018	0.00018	0.00018	0.00018	0.00018	0.00018
A_{sy} = [illegible]	cm²	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27	5.27
Longitud de varilla = L_y - 10	cm	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	**5.27**
A_{sy} Máximo	cm²	**5.27**
EN SENTIDO X USAR	-	**5 VARILLAS No. 4 L = 1.2 m. @ 30 cm.**
EN SENTIDO Y USAR	-	**5 VARILLAS No. 4 L = 1.2 m. @ 30 cm.**

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE A

ZAPATA CONCENTRICA No. G-2

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	2.40	Ton/m³	β =	0.85	-
Peso unitario del suelo (γ_s)	1.80	Ton/m³	$\phi v_c = \phi \cdot 0.27 \cdot (2+4/\beta_c) \cdot f'_c{}^{0.5}$ =	15.52	Kg/cm²
Capacidad admisible del suelo (q_{adm})	12.00	Ton/m²	α_s =	20.00	-
Profundidad de desplante (D)	1.50	m	d =	22.50	cm
Area columnas (A_c)	0.24	m²	b_o =	290.00	cm
$b_{columna}$ (Sentido X)	40.00	cm	$\phi v_c = \phi \cdot 0.27 \cdot (2+\alpha_s d/b_o) \cdot f'_c{}^{0.5}$ =	11.01	Kg/cm²
$h_{columna}$ (Sentido Y)	60.00	cm	$\phi v_c = \phi \cdot 1.1 \cdot f'_c{}^{0.5}$ =	13.55	Kg/cm²
β_c	1.50	-			
f_y	4,200.00	Kg/cm²	ϕv_c (como losa) =	11.01	Kg/cm²
f'_c	210.00	Kg/cm²	$\phi v_c = \phi \cdot 0.53 \cdot f'_c{}^{0.5}$ (como viga) =	6.53	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		COMBINACIONES DE CARGA																
Ancho zapata en el sentido X (B_x)	m	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40
Largo zapata en el sentido Y (L_y)	m	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40
B_{zap} / B_{colum}	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d_b columna	cm	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
d_b zapata	cm	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
l_d = ... > 0.0043·d_b·f_y	cm	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
h zapata req. H = (l_d+$d_{b,zap}$+2·$d_{b,zap}$+7.5)/100	m	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
H_z	m	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
d zapata = (H_z - 0.075)	m	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Area zapata (A)	m²	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
Peso zapata (W_z = A·H_z·γ_c)	Ton	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41
Peso suelo (W_s = γ_s·(A-A_c)·(D-H_z))	Ton	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72
Fz	Ton	8.15	8.44	8.37	7.56	8.34	8.34	8.49	8.49	8.52	8.52	8.83	8.83	5.06	5.06	5.23	5.23	0.00
Peso total (Wt = Fz+Ws+Wz)	Ton	13.28	13.57	13.50	12.69	13.47	13.47	13.62	13.62	13.64	13.64	13.75	13.75	10.21	10.21	10.36	10.36	5.13
Mx	Ton-m	-0.24	-0.34	-0.34	-0.62	0.26	0.26	0.67	0.67	0.11	0.11	0.65	0.65	0.39	0.39	1.10	1.10	0.00
Fy	Ton	0.25	0.24	0.24	0.25	0.60	0.55	0.80	0.80	0.43	0.43	0.66	0.66	0.40	0.40	0.71	0.71	0.00
My	Ton-m	0.17	0.10	0.10	0.10	1.62	1.62	1.17	1.17	1.27	1.27	0.62	0.62	1.06	1.06	1.11	1.11	0.00
Fx	Ton	0.24	0.24	0.26	0.21	1.06	1.06	0.76	0.76	0.61	0.61	0.64	0.64	0.90	0.90	0.67	0.67	0.00
M'x = Mx+Fy·H_z	Ton-m	0.42	0.41	0.41	0.93	0.11	0.11	0.73	0.73	0.02	0.02	0.45	0.45	0.27	0.27	0.89	0.89	0.00
M'y = My+Fx·H_z	Ton-m	0.24	0.24	0.24	0.16	1.92	1.92	1.40	1.40	1.51	1.51	1.12	1.12	1.82	1.82	1.31	1.31	0.00
e_x = M'y/Wt	m	0.02	0.02	0.02	0.01	0.14	0.14	0.10	0.10	0.11	0.11	0.08	0.08	0.18	0.18	0.13	0.13	0.00
e_y = M'x/Wt	m	0.03	0.03	0.03	0.07	0.01	0.01	0.05	0.05	0.00	0.00	0.03	0.03	0.03	0.03	0.09	0.09	0.00
6e_x/B_x	-	0.08	0.07	0.08	0.05	0.61	0.61	0.44	0.44	0.47	0.47	0.35	0.35	0.77	0.77	0.54	0.54	0.00
6e_y/L_y	-	0.13	0.13	0.13	0.31	0.03	0.03	0.23	0.23	0.00	0.00	0.14	0.14	0.11	0.11	0.37	0.37	0.00
q_{max} = (Wt/(B_x·L_y))·(1+6e_x/B_x+6e_y/L_y)	Ton/m²	8.21	8.34	8.31	8.87	11.30	11.30	11.80	11.80	10.30	10.30	10.48	10.48	8.79	8.79	10.10	10.10	2.62
q_{min} = (Wt/(B_x·L_y))·(1-6e_x/B_x-6e_y/L_y)	Ton/m²	6.34	5.81	5.46	4.09	2.44	2.44	2.29	2.29	3.82	3.82	3.88	3.88	0.63	0.63	0.47	0.47	2.62
CHEQUEO CAPACIDAD ADMISIBLE	-	O.K.																
DISEÑO ZAPATA - CARGAS MAYORADAS																		
Fz_u	Ton	11.41	10.25	10.35	10.35	10.58	10.58	7.61	7.61	7.62	7.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peso total mayorado (Wt_u = Fz_u+W_s+W_z)	Ton	18.59	15.63	15.73	15.73	15.94	15.94	12.99	12.99	13.21	13.21	5.38	5.38	5.38	5.38	5.38	5.38	5.38
Mx_u	Ton-m	-0.48	-0.41	0.40	0.45	1.46	1.46	0.50	0.50	1.56	1.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fy_u	Ton	0.26	0.29	0.60	0.60	1.08	1.08	0.59	0.59	1.02	1.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My_u	Ton-m	0.23	0.20	2.28	2.28	1.84	1.84	2.22	2.22	1.58	1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fx_u	Ton	0.36	0.36	1.36	1.36	1.04	1.04	1.29	1.29	0.96	0.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'x_u$ = Mx_u+Fy_u·H_z	Ton-m	0.58	0.49	0.64	0.64	1.79	1.79	0.73	0.73	1.87	1.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'y_u$ = My_u+Fx_u·H_z	Ton-m	0.33	0.28	2.69	2.69	1.95	1.95	2.62	2.62	1.88	1.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{xu} = $M'y_u$/Wt_u	m	0.02	0.02	0.17	0.17	0.12	0.12	0.20	0.20	0.14	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{yu} = $M'x_u$/Wt_u	m	0.03	0.03	0.04	0.04	0.11	0.11	0.06	0.06	0.14	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6e_{xu}/B_x	-	0.08	0.08	0.73	0.73	0.52	0.52	0.86	0.86	0.61	0.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6e_{yu}/L_y	-	0.13	0.13	0.17	0.17	0.48	0.48	0.24	0.24	0.61	0.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00
q_{umax} = (Wt_u/(B_x·L_y))·(1+6e_{xu}/B_x+6e_{yu}/L_y)	Ton/m²	11.49	9.67	15.30	15.30	15.30	15.30	13.93	13.93	14.93	14.93	2.75	2.75	2.75	2.75	2.75	2.75	2.75
q_{umin} = (Wt_u/(B_x·L_y))·(1-6e_{xu}/B_x-6e_{yu}/L_y)	Ton/m²	7.49	8.28	0.75	0.75	-0.03	-0.03	-0.67	-0.67	-1.45	-1.45	2.75	2.75	2.75	2.75	2.75	2.75	2.75
ACCION COMO VIGA																		
DIRECCION X																		
V_u = q_{umax}·L_y·((B_x-b_c)/2-d)	Ton	4.42	3.72	5.69	5.69	6.27	6.27	5.36	5.36	5.75	5.75	1.06	1.06	1.06	1.06	1.06	1.06	1.06
v_u = V_u/(L_y·d)·10	Kg/cm²	1.40	1.18	1.87	1.87	1.99	1.99	1.70	1.70	1.82	1.82	0.34	0.34	0.34	0.34	0.34	0.34	0.34
v_u ≤ ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN X - v_{uMAX}	Kg/cm²	1.99																
DIRECCION Y																		
V_u = q_{umax}·B_x·((L_y-h_c)/2-d)	Ton	2.82	2.67	3.75	3.75	3.99	3.99	3.41	3.41	3.68	3.68	0.67	0.67	0.67	0.67	0.67	0.67	0.67
v_u = V_u/(B_x·d)·10	Kg/cm²	0.89	0.75	1.19	1.19	1.27	1.27	1.08	1.08	1.16	1.16	0.21	0.21	0.21	0.21	0.21	0.21	0.21
v_u ≤ ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN Y - v_{uMAX}	Kg/cm²	1.27																
ACCION COMO LOSA																		
b_o	cm	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00
V_u = q_{umax}·(A-(b_c+d)·(h_c+d))	Ton	18.80	13.86	22.10	22.10	23.34	23.34	20.12	20.12	21.38	21.38	3.87	3.87	3.87	3.87	3.87	3.87	3.87
v_u = V_u/(b_o·d)	Kg/cm²	2.54	2.14	3.39	3.39	3.61	3.61	3.08	3.08	3.30	3.30	0.61	0.61	0.61	0.61	0.61	0.61	0.61
v_u ≤ ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO LOSA - v_{uMAX}	Kg/cm²	3.61																
DISEÑO A FLEXION EN DOS DIRECCIONES																		
DIRECCION X																		
M_{ux} = q_{umax}·L_y·((B_x-b_c)/2)²/2	Ton-cm	201.39	333.28	535.43	535.43	570.43	570.43	487.83	487.83	522.53	522.53	96.12	96.12	96.12	96.12	96.12	96.12	96.12
K_u = M_{ux}/(L_y·d²)	Ton/cm²	0.00284	0.00477	0.00755	0.00755	0.00805	0.00805	0.00688	0.00688	0.00737	0.00737	0.00136	0.00136	0.00136	0.00136	0.00136	0.00136	0.00136
ρ_x = (0.85·f'_c/f_y)·(1-(1-(2.6222·K_u/f'_c))^0.5) ≥ 0.0018	-	0.00076	0.00128	0.00205	0.00205	0.00219	0.00219	0.00187	0.00187	0.00200	0.00200	0.00036	0.00036	0.00036	0.00036	0.00036	0.00036	0.00036
A_{sx} = ρ_x·L_y·d	cm²	5.67	5.67	6.47	6.47	6.91	6.91	5.88	5.88	6.31	6.31	5.67	5.67	5.67	5.67	5.67	5.67	5.67
Longitud de varilla = B_x - 10	cm	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00
DIRECCION Y																		
M_{uy} = q_{umax}·B_x·((L_y-h_c)/2)²/2	Ton-cm	287.45	219.86	342.87	342.87	365.07	365.07	312.02	312.02	334.42	334.42	61.82	61.82	61.82	61.82	61.82	61.82	61.82
K_u = M_{uy}/(B_x·d²)	Ton/cm²	0.00360	0.00309	0.00482	0.00482	0.00515	0.00515	0.00440	0.00440	0.00472	0.00472	0.00087	0.00087	0.00087	0.00087	0.00087	0.00087	0.00087
ρ_y = (0.85·f'_c/f_y)·(1-(1-(2.6222·K_u/f'_c))^0.5) ≥ 0.0018	-	0.00100	0.00083	0.00128	0.00136	0.00147	0.00147	0.00125	0.00125	0.00134	0.00134	0.00024	0.00024	0.00024	0.00024	0.00024	0.00024	0.00024
A_{sy} = ρ_y·B_x·d	cm²	5.67	5.67	6.47	6.47	6.91	6.91	5.88	5.88	6.31	6.31	5.67	5.67	5.67	5.67	5.67	5.67	5.67
Longitud de varilla = L_y - 10	cm	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	6.91
A_{sy} Máximo	cm²	6.91
EN SENTIDO X USAR	-	6 VARILLAS No. 4 L = 1.3 m. @ 25 cm.
EN SENTIDO Y USAR	-	6 VARILLAS No. 4 L = 1.3 m. @ 25 cm.

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE A

ZAPATA CONCENTRICA No. B-4

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	= 2.40	Ton/m³		α =	0.85	-
Peso unitario del suelo (γ_s)	= 1.80	Ton/m³		ϕv_c =	15.02	Kg/cm²
Capacidad admisible del suelo (q_{adm})	= 12.00	Ton/m²		α_s =	20.00	-
Profundidad de desplante (D)	= 1.50	m.		d =	22.00	cm.
Area columnas (A_c)	= 0.24	m²		b_o =	280.00	cm.
b_{colum} (Sentido X)	= 40.00	cm.		ϕv_c =	11.81	Kg/cm²
l_{colum} (Sentido Y)	= 60.00	cm.		ϕv_c =	13.55	Kg/cm²
β_c	= 1.50	-				
f_y	= 4,200.00	Kg/cm²		ϕv_c (como losa) =	11.81	Kg/cm²
f'_c	= 210.00	Kg/cm²		ϕv_c (como viga) =	6.53	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8
Ancho zapata en el sentido X (B_x)	m.	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40
Largo zapata en el sentido Y (L_y)	m.	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40
B_{zap} / R_{zap}	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
β_c columna	cm.	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
β_c zapata	cm.	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
[illegible]	cm.	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17

CHEQUEO CAPACIDAD ADMISIBLE — O.K.

DISEÑO ZAPATA - CARGAS MAYORADAS

ACCION COMO VIGA

CHEQUEO ACCION COMO VIGA EN X - v_{maxx} — Kg/cm² — 1.87

CHEQUEO ACCION COMO VIGA EN Y - v_{maxy} — Kg/cm² — 1.18

ACCION COMO LOSA

CHEQUEO ACCION COMO LOSA - v_{maxx} — Kg/cm² — 3.39

DISEÑO A FLEXION EN DOS DIRECCIONES

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	5.60
A_{sy} Máximo	cm²	5.60
EN SENTIDO X USAR	-	6 VARILLAS No. 4 L = 1.3 m. @ 26 cm.
EN SENTIDO Y USAR	-	6 VARILLAS No. 4 L = 1.3 m. @ 26 cm.

7.4 DISEÑO DE VIGAS Y COLUMNAS

7.4.1 VIGAS

V-101/ N+3.45

B=0.40 H=0.45 L=4.87			B=0.40 H=0.45 L=4.87			B=0.40 H=0.45 L=4.87		
Mu=-17.36 As =9.66 As(r)=5.23		Mu=-25.34 As =9.66 As(r)=5.23	Mu=-19.56 As =9.66 As(r)=5.23		Mu=-20.73 As =9.66 As(r)=5.23	Mu=-17.62 As =9.66 As(r)=5.23		Mu=-32.07 As =9.66 As(r)=5.23
	Mu=8.82 As =6.50 As(r)=5.23			Mu=7.00 As =6.50 As(r)=5.23			Mu=8.02 As =6.50 As(r)=5.23	
Vu=-15.92	Vu=6.02	Vu=19.68	Vu=-16.53	Vu=3.31	Vu=16.97	Vu=-15.41	Vu=6.51	Vu=20.17

B=0.40 H=0.45 L=1.90		
Mu=-33.55 As =9.66 As(r)=5.23		Mu=-0.43 As =0.00 As(r)=5.23
	Mu=0.00 As =6.50 As(r)=5.23	
Vu=-21.71	Vu=-15.06	Vu=-8.40

V-102/ N+3.45

B=0.40 H=0.45 L=4.87			B=0.40 H=0.45 L=4.87			B=0.40 H=0.45 L=4.87		
Mu=-17.49 As =9.66 As(r)=5.23		Mu=-24.27 As =9.66 As(r)=5.23	Mu=-17.44 As =9.66 As(r)=5.23		Mu=-25.87 As =9.66 As(r)=5.23	Mu=-33.65 As =9.66 As(r)=5.23		Mu=-54.51 As =9.66 As(r)=5.23
	Mu=9.04 As =6.50 As(r)=5.23			Mu=6.47 As =6.50 As(r)=5.23			Mu=22.14 As =6.50 As(r)=5.23	
Vu=-16.04	Vu=5.68	Vu=19.34	Vu=-15.05	Vu=4.59	Vu=18.25	Vu=-34.61	Vu=7.63	Vu=42.99

B=0.40 H=0.45 L=1.90		
Mu=-57.77 As =9.66 As(r)=5.23		Mu=-0.00 As =0.00 As(r)=5.23
	Mu=0.00 As =6.50 As(r)=5.23	
Vu=-33.30	Vu=-26.65	Vu=-20.00

V-103/ N+3.45

B=0.40 H=0.45 L=4.87			B=0.40 H=0.45 L=4.87			B=0.40 H=0.45 L=4.87		
Mu=-18.76 As =9.66 As(r)=5.23		Mu=-24.26 As =9.66 As(r)=5.23	Mu=-16.03 As =9.66 As(r)=5.23		Mu=-32.34 As =9.66 As(r)=5.23	Mu=-52.99 As =9.66 As(r)=5.23		Mu=-68.38 As =9.66 As(r)=5.23
	Mu=12.13 As =6.50 As(r)=5.23			Mu=8.08 As =6.50 As(r)=5.23			Mu=40.77 As =6.50 As(r)=5.23	
Vu=-16.58	Vu=5.80	Vu=19.46	Vu=-13.80	Vu=6.33	Vu=19.99	Vu=-57.40	Vu=6.90	Vu=63.27

B= 0.40 H= 0.45 L= 1.90	
Mu=-51.01 As =9.66 As(r)=5.23	Mu=-0.00 As =0.00 As(r)=5.23
Mu=0.00 As =6.50 As(r)=5.23	
Vu=-29.99 Vu=-23.33 Vu=-16.68	

V-104/ N+3.45

B= 0.40 H= 0.45 L= 4.87	B= 0.40 H= 0.45 L= 4.87	B= 0.40 H= 0.45 L= 4.87
Mu=-20.16 As =9.66 As(r)=5.23 / Mu=-26.14 As =9.66 As(r)=5.23	Mu=-19.07 As =9.66 As(r)=5.23 / Mu=-28.85 As =9.66 As(r)=5.23	Mu=-37.90 As =9.66 As(r)=5.23 / Mu=-45.96 As =9.66 As(r)=5.23
Mu=9.14 As =6.50 As(r)=5.23	Mu=7.21 As =6.50 As(r)=5.23	Mu=23.97 As =6.50 As(r)=5.23
Vu=-17.04 Vu=6.48 Vu=20.14	Vu=-15.53 Vu=5.58 Vu=19.24	Vu=-36.16 Vu=5.99 Vu=38.78

B= 0.40 H= 0.45 L= 1.90	
Mu=-26.12 As =9.66 As(r)=5.23	Mu=-0.76 As =0.00 As(r)=5.23
Mu=0.00 As =6.50 As(r)=5.23	
Vu=-18.18 Vu=-11.53 Vu=-5.00	

V-105/ N+3.45

B= 0.40 H= 0.45 L= 3.40	B= 0.40 H= 0.45 L= 5.66	B= 0.40 H= 0.45 L= 5.66
Mu=-13.83 As =9.66 As(r)=5.23 / Mu=-16.76 As =9.66 As(r)=5.23	Mu=-22.69 As =9.66 As(r)=5.23 / Mu=-26.25 As =9.66 As(r)=5.23	Mu=-24.74 As =9.66 As(r)=5.23 / Mu=-19.35 As =9.66 As(r)=5.23
Mu=4.19 As =7.92 As(r)=5.23	Mu=12.63 As =7.92 As(r)=5.23	Mu=10.62 As =7.92 As(r)=5.23
Vu=-13.05 Vu=4.87 Vu=15.24	Vu=-19.85 Vu=-3.12 Vu=23.51	Vu=-19.97 Vu=-2.88 Vu=17.89

V-106/ N+3.45

B= 0.40 H= 0.45 L= 3.40	B= 0.40 H= 0.45 L= 5.66	B= 0.40 H= 0.45 L= 5.66
Mu=-14.62 As =9.66 As(r)=5.23 / Mu=-17.26 As =9.66 As(r)=5.23	Mu=-25.21 As =9.66 As(r)=5.23 / Mu=-30.60 As =9.66 As(r)=5.23	Mu=-25.77 As =9.66 As(r)=5.23 / Mu=-19.12 As =9.66 As(r)=5.23
Mu=4.32 As =7.92 As(r)=5.23	Mu=15.48 As =7.92 As(r)=5.23	Mu=10.36 As =7.92 As(r)=5.23
Vu=-13.11 Vu=5.01 Vu=15.37	Vu=-21.14 Vu=-4.73 Vu=29.12	Vu=-20.17 Vu=-3.21 Vu=17.69

V-107/ N+3.45

B= 0.40 H= 0.45 L= 3.40	B= 0.40 H= 0.45 L= 5.66	B= 0.40 H= 0.45 L= 5.66
Mu=-23.55 As =9.66 As(r)=5.23 / Mu=-35.81 As =9.66 As(r)=5.23	Mu=-59.65 As =9.66 As(r)=5.23 / Mu=-60.88 As =9.66 As(r)=5.23	Mu=-33.17 As =9.66 As(r)=5.23 / Mu=-20.23 As =9.66 As(r)=5.23

	Mu=8.95 As =7.92 As(r)=5.23			Mu=39.22 As =7.92 As(r)=5.23			Mu=8.55 As =7.92 As(r)=5.23	
Vu=-23.88	Vu=9.09	Vu=30.75	Vu=-51.76	Vu=-5.31	Vu=53.90	Vu=-21.40	Vu=-4.96	Vu=16.71

V-108/ N+3.45

B=0.40 H=0.45 L=3.40			B=0.40 H=0.45 L=5.66			B=0.40 H=0.45 L=5.66		
Mu=-25.94 As =9.66 As(r)=5.23		Mu=-40.20 As =9.66 As(r)=5.23	Mu=-60.26 As =9.66 As(r)=5.23		Mu=-60.52 As =9.66 As(r)=5.23	Mu=-36.16 As =9.66 As(r)=5.23		Mu=-22.28 As =9.66 As(r)=5.23
	Mu=10.05 As =7.92 As(r)=5.23			Mu=38.66 As =7.92 As(r)=5.23			Mu=9.17 As =7.92 As(r)=5.23	
Vu=-25.35	Vu=11.61	Vu=33.26	Vu=-51.30	Vu=-4.70	Vu=52.51	Vu=-22.37	Vu=-6.15	Vu=17.54

V-109/ N+3.45

B=0.20 H=0.45 L=3.60			B=0.20 H=0.45 L=5.86			B=0.20 H=0.45 L=5.86		
Mu=-4.05 As =3.96 As(r)=2.61		Mu=-7.06 As =3.96 As(r)=2.61	Mu=-8.49 As =3.96 As(r)=2.61		Mu=-8.51 As =3.96 As(r)=2.61	Mu=-11.38 As =3.96 As(r)=2.61		Mu=-6.36 As =3.96 As(r)=2.61
	Mu=1.77 As =3.96 As(r)=2.61			Mu=6.36 As =3.96 As(r)=2.61			Mu=6.76 As =3.96 As(r)=2.61	
Vu=-5.00	Vu=1.82	Vu=7.22	Vu=-9.46	Vu=0.41	Vu=9.47	Vu=-10.53	Vu=-1.53	Vu=8.40

7.4.2 COLUMNAS

Columna F-1

Nivel	H Libre	Losa	B	H	M1	M2	P	V1	V2	Cuantia	m/mr	Col/Viq Eje ppal	Col/viq Eje sec
N+3.45					18.82	16.06				16/#4 #5 (1.1%)	0.11	1.42	1.22
	3.05	.45	.60	.40			-59.74	11.50	12.12				
		1.50			-21.42	-15.86				16/#4 #5 (1.1%)	0.12		

Columna F-2

Nivel	H Libre	Losa	B	H	M1	M2	P	V1	V2	Cuantia	m/mr	Col/Viq Eje ppal	Col/viq Eje sec
N+3.45					-25.06	5.50				16/#6 #5 (1.6%)	0.11	1.20	1.72
	3.05	.45	.60	.40			-82.16	15.34	13.10				
		1.50			28.63	2.07				16/#6 #5 (1.6%)	0.12		

Columnas F-3, E-3, E-4

Nivel	H Libre	Losa	B	H	M1	M2	P	V1	V2	Cuantia	m/mr	Col/Viq Eje ppal	Col/viq Eje sec
N+3.45					35.68	35.92				16/#5 #6 (1.6%)	0.17	1.23	1.77
	3.05	.45	.60	.40			-158.72	18.66	23.83				
		1.50			-29.62	-27.80				16/#5 #6 (1.6%)	0.14		

Columna F-4

Nivel	H Libre	Losa	B	H	M1	M2	P	V1	V2	Cuantia	m/mr	Col/Viq Eje ppal	Col/viq Eje sec
N+3.45					-5.28	53.16				10/#7 (1.6%)	0.14	1.24	1.81
	3.05	.45	.60	.40			-167.60	14.49	30.32				
		1.50			-1.43	-52.97				10/#7 (1.6%)	0.14		

Columna E-1

Nivel	H Libre	Losa	B	H	M1	M2	P	V1	V2	Cuantia	m/mr	Col/Viq Eje ppal	Col/viq Eje sec
N+3.45					17.53	3.71				16/#5 #4 (1.1%)	0.10	1.42	1.23
	3.05	.45	.60	.40			-69.77	10.58	8.54				
		1.50			-19.38	-10.39				16/#5 #4 (1.1%)	0.11		

Columnas E-2, D-2, D-4, G-3, G-4

Nivel	H Libre	Losa	B	H	M1	M2	P	V1	V2	Cuantia	m/mr	Col/Viq Eje ppal	Col/viq Eje sec
N+3.45					-22.59	-10.77				14/#6 (1.7%)	0.09	1.23	1.79
	3.05	.45	.60	.40			-94.29	14.02	9.72				
		1.50			26.48	9.70				14/#6 (1.7%)	0.11		

Columnas D-1, G-1

Nivel	H Libre	Losa	B	H	M1	M2	P	V1	V2	Cuantia	m/mr	Col/Viq Eje ppal	Col/viq Eje sec
N+3.45					17.23	-8.53				12/#5 (1.0%)	0.10	1.31	2.07
	3.05	.45	.60	.40			-52.58	10.46	10.24				
		1.50			-19.40	-4.31				12/#5 (1.0%)	0.12		

Columna D-3

Nivel	H Libre	Losa	B	H	M1	M2	P	V1	V2	Cuantia	m/mr	Col/Viq Eje ppal	Col/viq Eje sec
N+3.45					-21.65	-11.61				10/#7 #8 (1.8%)	0.09	1.31	3.56
	3.05	.45	.60	.40			-75.77	13.71	10.87				
		1.50			26.32	13.95				10/#7 #8 (1.8%)	0.10		

Columna G-2

Nivel	H Libre	Losa	B	H	M1	M2	P	V1	V2	Cuantia	m/mr	Col/Viq Eje ppal	Col/viq Eje sec
N+3.95					-25.94	-1.12				12/#7 #6 (1.7%)	0.11	1.22	3.21
	3.05	.45	.60	.40			-72.49	16.16	6.77				
		1.50			30.61	5.03				12/#7 #6 (1.7%)	0.13		

7.5 DISEÑO DE ELEMNTOS COMPLEMENTARIOS

1 Design Data

This chapter provides design data and results.

1.1 Steel Frame Design

Table 1.1 - Steel Frame Preferences - AISC 360-10

Item	Value
Multi-Response Design	Step-by-Step
Frame Type	OMF
Seismic Design Grade	D
Importance Factor	1
Design System Rho	0
Design System Sds	1
Design System R	8
Design System Omega0	3
Design System Cd	5.5
Design Provision	LRFD
Analysis Method	Direct Analysis
Second Order Method	General 2nd Order
Stiffness Reduction Method	Tau-b Fixed
Phi (Bending)	0.9
Phi (Compression)	0.9
Phi (Tension-Yielding)	0.9
Phi (Tension-Fracture)	0.75
Phi (Shear)	0.9
Phi (Shear-Short Webbed Rolled I)	1
Phi (Torsion)	0.9
Ignore Seismic Code?	No
Ignore Special Seismic Load?	No
Doubler Plate Plug-Welded?	Yes
HSS Welding Type	ERW
Reduced HSS Thickness	No
Consider Deflection?	Yes
DL Ratio	120
SDL+LL Ratio	120
LL Ratio	360
Total Ratio	240
Total Camber Limit	240
Pattern Live Load Factor	0.75
D/C Ratio Limit	0.95

Table 1.2 - Steel Column Envelope

Label	Story	Section	Moment Interaction Check	PMM Combo	V22 Ratio	V33 Ratio	Class	Cont. Plate cm²	Dbl. Plate mm	B/C Ratio Major	B/C Ratio Minor
C20-1	N+5.34	PERFILCOL	0.219 = 0.014 + 0.012 + 0.193	COMDIS11	0.005	0.028	Slender				
C28	N+5.34	PERFILCOL	0.356 = 0.002 + 0.012 + 0.341	COMDIS8	0.012	0.026	Slender				
C21-1	N+5.34	PERFILCOL	0.34 = 0.024 + 0.002 + 0.315	COMDIS11	0.006	0.046	Slender				
C29	N+5.34	PERFILCOL	0.566 = 0.004 + 1.303E-04 + 0.561	COMDIS8	0.013	0.042	Slender				
C22-1	N+5.34	PERFILCOL	0.237 = 0.015 + 0.011 + 0.211	COMDIS11	0.005	0.048	Slender				
C30	N+5.34	PERFILCOL	0.497 = 0.007 + 0.004 + 0.486	COMDIS8	0.014	0.036	Slender				
C31	N+5.34	PERFILCOL	0.305 = 0.009 + 0.019 + 0.277	COMDIS8	0.012	0.02	Slender				
C20	N+3.95	PERFILCOL	0.209 = 0.014 + 0.012 + 0.184	COMDIS11	0.007	0.028	Slender				
C21	N+3.95	PERFILCOL	0.325 = 0.024 + 0.001 + 0.3	COMDIS11	0.013	0.046	Slender				

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Label	Story	Section	Moment Interaction Check	PMM Combo	V22 Ratio	V33 Ratio	Class	Cont. Plate cm²	Dbl. Plate mm	B/C Ratio Major	B/C Ratio Minor
C22	N+3.95	PERFILCOL	0.27 = 0.003 + 0.008 + 0.259	COMDIS8	0.007	0.05	Slender				
C3-2	N+3.95	PERFILCOL	0.249 = 0.015 + 0.013 + 0.221	COMDIS8	0.008	0.028	Slender				
C28	N+3.95	PERFILCOL	0.181 = 0.002 + 0.008 + 0.171	COMDIS8	0.012	0.026	Slender				
C6-1	N+3.95	PERFILCOL	0.415 = 0.027 + 0.006 + 0.383	COMDIS8	0.01	0.049	Slender				
C29	N+3.95	PERFILCOL	0.291 = 0.004 + 0.003 + 0.284	COMDIS8	0.013	0.042	Slender				
C9-1	N+3.95	PERFILCOL	0.429 = 0.028 + 0.006 + 0.395	COMDIS8	0.01	0.057	Slender				
C30	N+3.95	PERFILCOL	0.241 = 0.007 + 0.005 + 0.229	COMDIS8	0.014	0.036	Slender				
C12-1	N+3.95	PERFILCOL	0.249 = 0.015 + 0.015 + 0.219	COMDIS8	0.008	0.021	Slender				
C31	N+3.95	PERFILCOL	0.15 = 0.003 + 0.136 + 0.021	COMDIS3	0.012	0.02	Slender	-23.4	-100	0	0

Table 1.3 - Steel Beam Envelope

Label	Story	Section	Moment Interaction Check	PMM Combo	V22 Ratio	V33 Ratio	Class	Conn. V I-End kN	Conn. V J-End kN
B12	N+5.93	180X65X4	0.035 = 0.001 + 0.015 + 0.019	COMDIS3	0.002	0.001	Seismic MD	0	0
B13	N+5.93	180X65X4	0.035 = 0.001 + 0.015 + 0.02	COMDIS3	0.002	0.002	Seismic MD	0	0
B83	N+5.34	180X65X4	0.057 = 0 + 0.048 + 0.009	COMDIS11	0.003	0.001	Seismic MD	0	0
B84	N+5.34	180X65X4	0.053 = 0 + 0.048 + 0.005	COMDIS8	0.002	0.001	Seismic MD	0	0
B85	N+5.34	180X65X4	0.06 = 0 + 0.051 + 0.009	COMDIS11	0.003	0.001	Seismic MD	0	0
B86	N+5.34	180X65X4	0.095 = 0 + 0.083 + 0.012	COMDIS9	0.004	0.001	Seismic MD	0	0
B87	N+5.34	180X65X4	0.093 = 0 + 0.083 + 0.011	COMDIS9	0.004	0.001	Seismic MD	0	0
B93	N+5.34	180X65X4	0.091 = 0.002 + 0.059 + 0.031	COMDIS3	0.004	0.002	Seismic MD	-2.159	2.3923
B94	N+5.34	180X65X4	0.079 = 0.004 + 0.047 + 0.028	COMDIS3	0.004	0.002	Seismic MD	-1.7788	1.6727
B95	N+5.34	180X65X4	0.105 = 0.005 + 0.061 + 0.04	COMDIS3	0.004	0.003	Seismic MD	-2.4389	2.3418
B79	N+3.45	180X65X4	0.088 = 0.003 + 0.084 + 0.001	COMDIS11	0.008	0.009	Seismic MD	1.922	0
B80	N+3.45	180X65X4	0.145 = 0.005 + 0.139 + 0	COMDIS11	0.012	0.012	Seismic MD	3.1102	0
B81	N+3.45	180X65X4	0.136 = 0.005 + 0.13 + 3.935E-04	COMDIS11	0.011	0.012	Seismic MD	2.9142	0
B82	N+3.45	180X65X4	0.085 = 0.004 + 0.011 + 0.071	COMDIS3	0.007	0.01	Seismic MD	0	1.4588
B88	N+3.45	180X65X4	0.062 = 0.001 + 0.021 + 0.04	COMDIS3	0.003	0.003	Seismic MD	0	0
B89	N+3.45	180X65X4	0.056 = 0 + 0.019 + 0.037	COMDIS3	0.002	0.003	Seismic MD	0	0
B90	N+3.45	180X65X4	0.056 = 0.001 + 0.015 + 0.04	COMDIS3	0.002	0.003	Seismic MD	0	0
B91	N+3.45	180X65X4	0.052 = 4.555E-04 + 0.021 + 0.03	COMDIS3	0.003	0.002	Seismic MD	0	0
B92	N+3.45	180X65X4	0.052 = 4.526E-04 + 0.021 + 0.03	COMDIS3	0.003	0.002	Seismic MD	0	0
B96	N+3.45	180X65X4	0.073 = 0.002 + 0.07 + 0.001	COMDIS8	0.005	0.005	Seismic MD	0	1.3426
B97	N+3.45	180X65X4	0.111 = 0.005 + 0.106 + 0	COMDIS8	0.008	0.007	Seismic MD	0	2.1064
B98	N+3.45	180X65X4	0.105 = 0.002 + 0.102 + 0.001	COMDIS8	0.007	0.005	Seismic MD	0	1.9295

Table 1.4 - Steel Brace Envelope

Label	Story	Section	Moment Interaction Check	PMM Combo	V22 Ratio	V33 Ratio	Class	Conn. P I-End kN	Conn. P J-End kN
D92	N+5.93	180X65X4	0.156 = 3.467E-04 + 0.152 + 0.003	COMDIS11	0.018	0.004	Seismic MD	-0.7795	-0.4245
D106	N+5.93	180X65X4	0.303 = 0.001 + 0.302 + 4.987E-04	COMDIS11	0.034	0.007	Seismic MD	-1.6606	-1.0678
D113	N+5.93	180X65X4	0.169 = 4.74E-04 + 0.165 +	COMDIS11	0.019	0.005	Seismic MD	-1.0237	-0.4309

Label	Story	Section	Moment Interaction Check	PMM Combo	V22 Ratio	V33 Ratio	Class	Conn. P I-End kN	Conn. P J-End kN
			0.004						
D87	N+5.34	180X65X4	0.413 = 0.016 + 0.395 + 0.002	COMDIS8	0.04	0.009	Seismic MD	-7.0703	-4.2144
D88	N+5.34	180X65X4	0.143 = 0.006 + 0.135 + 0.002	COMDIS11	0.018	0.004	Seismic MD	7.1989	7.2172
D100	N+5.34	180X65X4	0.434 = 0.017 + 0.415 + 0.002	COMDIS11	0.038	0.005	Seismic MD	-5.7522	-3.7837
D102	N+5.34	180X65X4	0.706 = 0.02 + 0.686 + 1.137E-04	COMDIS8	0.071	0.01	Seismic MD	-11.6002	-5.7055
D103	N+5.34	180X65X4	0.245 = 0.013 + 0.232 + 1.752E-04	COMDIS11	0.032	0.007	Seismic MD	14.6825	14.7101
D107	N+5.34	180X65X4	0.706 = 0.016 + 0.689 + 0.001	COMDIS11	0.064	0.005	Seismic MD	-8.8563	-4.1143
D109	N+5.34	180X65X4	0.748 = 0.054 + 0.693 + 0.001	COMDIS8	0.071	0.01	Seismic MD	-14.043	-11.1118
D110	N+5.34	180X65X4	0.155 = 0.007 + 0.147 + 0.001	COMDIS11	0.02	0.004	Seismic MD	7.7551	7.7827
D114	N+5.34	180X65X4	0.471 = 0.017 + 0.453 + 0.002	COMDIS11	0.041	0.005	Seismic MD	-12.517	-8.8349
D116	N+5.34	180X65X4	0.408 = 0.017 + 0.39 + 0.001	COMDIS8	0.04	0.009	Seismic MD	-4.3406	-2.7412
D82	N+3.95	180X65X4	0.113 = 0.006 + 0.105 + 0.002	COMDIS11	0.016	0.004	Seismic MD	6.9967	7.1989
D90	N+3.95	180X65X4	0.154 = 0.006 + 0.146 + 0.002	COMDIS8	0.021	0.006	Seismic MD	6.6103	6.976
D91	N+3.95	180X65X4	0.482 = 0.013 + 0.466 + 0.002	COMDIS8	0.042	0.012	Seismic MD	-7.4745	-7.4376
D101	N+3.95	180X65X4	0.191 = 0.013 + 0.178 + 1.47E-04	COMDIS11	0.029	0.005	Seismic MD	14.3777	14.6825
D104	N+3.95	180X65X4	0.27 = 0.013 + 0.256 + 0.001	COMDIS8	0.036	0.008	Seismic MD	13.636	14.2467
D105	N+3.95	180X65X4	0.829 = 0.017 + 0.812 + 1.561E-04	COMDIS8	0.075	0.015	Seismic MD	-12.2921	-12.2305
D108	N+3.95	180X65X4	0.122 = 0.007 + 0.114 + 0.001	COMDIS11	0.018	0.004	Seismic MD	7.4502	7.7551
D111	N+3.95	180X65X4	0.259 = 0.011 + 0.246 + 0.002	COMDIS8	0.035	0.008	Seismic MD	11.8703	12.481
D112	N+3.95	180X65X4	0.865 = 0.045 + 0.819 + 0.001	COMDIS8	0.075	0.015	Seismic MD	-14.8297	-14.7681
D118	N+3.95	180X65X4	0.151 = 0.006 + 0.143 + 0.001	COMDIS8	0.02	0.006	Seismic MD	6.7842	7.15
D119	N+3.95	180X65X4	0.476 = 0.014 + 0.461 + 0.002	COMDIS8	0.042	0.012	Seismic MD	-4.3775	-4.3406

Table 1.5 - Steel Frame Summary - AISC 360-10 (Part 1 of 2)

Story	Label	Unique Name	Design Type	Design Section	Status	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio
N+5.34	C20-1	52	Column	PERFILCOL	No Message	COMDIS11(C)	0.219	0.014	0.012	0.193
N+5.34	C20-1		Column	PERFILCOL	No Message	COMDIS9(T)	0.15	0.008	0.007	0.135
N+5.34	C28	59	Column	PERFILCOL	No Message	COMDIS8(C)	0.356	0.002	0.012	0.341
N+5.34	C28		Column	PERFILCOL	No Message	COMDIS9(T)	0.339	0.000329	0.009	0.33
N+5.34	C21-1	65	Column	PERFILCOL	No Message	COMDIS11(C)	0.34	0.024	0.002	0.315
N+5.34	C21-1		Column	PERFILCOL	No Message	COMDIS9(T)	0.236	0.014	0.001	0.221
N+5.34	C29	72	Column	PERFILCOL	No Message	COMDIS8(C)	0.566	0.004	0.0001303	0.561
N+5.34	C29		Column	PERFILCOL	No Message	COMDIS9(T)	0.54	0.0002023	0.0003735	0.54
N+5.34	C22-1	77	Column	PERFILCOL	No Message	COMDIS11(C)	0.237	0.015	0.011	0.211
N+5.34	C22-1		Column	PERFILCOL	No Message	COMDIS9(T)	0.141	0.006	0.006	0.128
N+5.34	C30	84	Column	PERFILCOL	No Message	COMDIS8(C)	0.497	0.007	0.004	0.486
N+5.34	C31	90	Column	PERFILCOL	No Message	COMDIS8(C)	0.305	0.009	0.019	0.277
N+5.34	C31		Column	PERFILCO	No	COMDIS11(T	0.191	0.004	0.003	0.184

Story	Label	Unique Name	Design Type	Design Section	Status	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio
				L	Message	)				
N+3.95	C20	50	Column	PERFILCO L	No Message	COMDIS11(C)	0.209	0.014	0.012	0.184
N+3.95	C20		Column	PERFILCO L	No Message	COMDIS8(T)	0.163	0.006	0.0002398	0.157
N+3.95	C21	63	Column	PERFILCO L	No Message	COMDIS11(C)	0.325	0.024	0.001	0.3
N+3.95	C21		Column	PERFILCO L	No Message	COMDIS8(T)	0.267	0.011	0.009	0.247
N+3.95	C22	75	Column	PERFILCO L	No Message	COMDIS11(C)	0.227	0.015	0.011	0.201
N+3.95	C22		Column	PERFILCO L	No Message	COMDIS8(T)	0.27	0.003	0.008	0.259
N+3.95	C3-2	53	Column	PERFILCO L	No Message	COMDIS8(C)	0.249	0.015	0.013	0.221
N+3.95	C3-2		Column	PERFILCO L	No Message	COMDIS11(T)	0.196	0.007	0.005	0.184
N+3.95	C28	58	Column	PERFILCO L	No Message	COMDIS8(C)	0.181	0.002	0.008	0.171
N+3.95	C28		Column	PERFILCO L	No Message	COMDIS9(T)	0.058	0	0.002	0.056
N+3.95	C6-1	66	Column	PERFILCO L	No Message	COMDIS8(C)	0.415	0.027	0.006	0.383
N+3.95	C6-1		Column	PERFILCO L	No Message	COMDIS11(T)	0.32	0.014	0.004	0.302
N+3.95	C29	71	Column	PERFILCO L	No Message	COMDIS8(C)	0.291	0.004	0.003	0.284
N+3.95	C9-1	78	Column	PERFILCO L	No Message	COMDIS8(C)	0.429	0.028	0.006	0.395
N+3.95	C9-1		Column	PERFILCO L	No Message	COMDIS11(T)	0.296	0.014	0.004	0.278
N+3.95	C30	83	Column	PERFILCO L	No Message	COMDIS8(C)	0.241	0.007	0.005	0.229
N+3.95	C12-1	86	Column	PERFILCO L	No Message	COMDIS8(C)	0.249	0.015	0.015	0.219
N+3.95	C12-1		Column	PERFILCO L	No Message	COMDIS11(T)	0.145	0.008	0.005	0.132
N+3.95	C31	89	Column	PERFILCO L	No Message	COMDIS3(C)	0.16	0.003	0.136	0.021
N+3.95	C31		Column	PERFILCO L	No Message	COMDIS11(T)	0.114	0.003	0.002	0.109
N+5.93	B12	102	Beam	180X65X4	No Message	COMDIS3(C)	0.035	0.001	0.015	0.019
N+5.93	B12		Beam	180X65X4	No Message	COMDIS11(T)	0.016	0	0.015	0.001
N+5.93	B13	103	Beam	180X65X4	No Message	COMDIS3(C)	0.035	0.001	0.015	0.02
N+5.93	B13		Beam	180X65X4	No Message	COMDIS11(T)	0.016	0	0.014	0.002
N+5.34	B83	94	Beam	180X65X4	No Message	COMDIS8(C)	0.046	0	0.037	0.009
N+5.34	B83		Beam	180X65X4	No Message	COMDIS11(T)	0.057	0	0.048	0.009
N+5.34	B84	95	Beam	180X65X4	No Message	COMDIS8(C)	0.053	0	0.048	0.005
N+5.34	B84		Beam	180X65X4	No Message	COMDIS11(T)	0.049	0	0.044	0.005
N+5.34	B85	96	Beam	180X65X4	No Message	COMDIS8(C)	0.054	0	0.042	0.012
N+5.34	B85		Beam	180X65X4	No Message	COMDIS11(T)	0.06	0	0.051	0.009
N+5.34	B86	97	Beam	180X65X4	No Message	COMDIS11(C)	0.085	0	0.071	0.014
N+5.34	B86		Beam	180X65X4	No Message	COMDIS9(T)	0.095	0	0.083	0.012
N+5.34	B87	98	Beam	180X65X4	No Message	COMDIS11(C)	0.082	0	0.07	0.012
N+5.34	B87		Beam	180X65X4	No Message	COMDIS9(T)	0.093	0	0.083	0.011
N+5.34	B93	106	Beam	180X65X4	No Message	COMDIS3(C)	0.091	0.002	0.059	0.031
N+5.34	B94	107	Beam	180X65X4	No Message	COMDIS3(C)	0.079	0.004	0.047	0.028
N+5.34	B95	108	Beam	180X65X4	No	COMDIS3(C)	0.105	0.005	0.061	0.04

Story	Label	Unique Name	Design Type	Design Section	Status Message	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio
N+3.45	B79	60	Beam	180X65X4	No Message	COMDIS3(C)	0.085	0.003	0.012	0.07
N+3.45	B79		Beam	180X65X4	No Message	COMDIS11(T)	0.088	0.003	0.084	0.001
N+3.45	B80	91	Beam	180X65X4	No Message	COMDIS8(C)	0.143	0.018	0.125	0.0003431
N+3.45	B80		Beam	180X65X4	No Message	COMDIS11(T)	0.145	0.005	0.139	0
N+3.45	B81	92	Beam	180X65X4	No Message	COMDIS3(C)	0.114	0.005	0.03	0.079
N+3.45	B81		Beam	180X65X4	No Message	COMDIS11(T)	0.136	0.005	0.13	0.0003935
N+3.45	B82	93	Beam	180X65X4	No Message	COMDIS3(C)	0.085	0.004	0.011	0.071
N+3.45	B82		Beam	180X65X4	No Message	COMDIS11(T)	0.066	0.002	0.063	0.001
N+3.45	B88	99	Beam	180X65X4	No Message	COMDIS3(C)	0.062	0.001	0.021	0.04
N+3.45	B88		Beam	180X65X4	No Message	COMDIS1(T)	0.019	0	0.019	0.0001044
N+3.45	B89	100	Beam	180X65X4	No Message	COMDIS4(C)	0.041	0	0.02	0.022
N+3.45	B89		Beam	180X65X4	No Message	COMDIS3(T)	0.056	0	0.019	0.037
N+3.45	B90	101	Beam	180X65X4	No Message	COMDIS3(C)	0.056	0.001	0.015	0.04
N+3.45	B90		Beam	180X65X4	No Message	COMDIS1(T)	0.013	0	0.013	0.0001254
N+3.45	B91	104	Beam	180X65X4	No Message	COMDIS3(C)	0.052	0.0004555	0.021	0.03
N+3.45	B91		Beam	180X65X4	No Message	COMDIS1(T)	0.02	0	0.02	0.0001742
N+3.45	B92	105	Beam	180X65X4	No Message	COMDIS3(C)	0.052	0.0004526	0.021	0.03
N+3.45	B92		Beam	180X65X4	No Message	COMDIS1(T)	0.02	0	0.02	0
N+3.45	B96	109	Beam	180X65X4	No Message	COMDIS3(C)	0.072	0.005	0.021	0.046
N+3.45	B96		Beam	180X65X4	No Message	COMDIS8(T)	0.073	0.002	0.07	0.001
N+3.45	B97	110	Beam	180X65X4	No Message	COMDIS3(C)	0.097	0.01	0.034	0.053
N+3.45	B97		Beam	180X65X4	No Message	COMDIS8(T)	0.111	0.005	0.106	0
N+3.45	B98	111	Beam	180X65X4	No Message	COMDIS3(C)	0.092	0.006	0.039	0.047
N+3.45	B98		Beam	180X65X4	No Message	COMDIS8(T)	0.105	0.002	0.102	0.001
N+5.93	D92	56	Brace	180X65X4	No Message	COMDIS11(C)	0.156	0.0003467	0.152	0.003
N+5.93	D106	69	Brace	180X65X4	No Message	COMDIS11(C)	0.303	0.001	0.302	0.0004987
N+5.93	D113	81	Brace	180X65X4	No Message	COMDIS11(C)	0.169	0.000474	0.165	0.004
N+5.34	D87	49	Brace	180X65X4	No Message	COMDIS8(C)	0.413	0.016	0.395	0.002
N+5.34	D88	51	Brace	180X65X4	No Message	COMDIS9(C)	0.115	0.003	0.11	0.002
N+5.34	D88		Brace	180X65X4	No Message	COMDIS11(T)	0.143	0.006	0.135	0.002
N+5.34	D100	57	Brace	180X65X4	No Message	COMDIS11(C)	0.434	0.017	0.415	0.002
N+5.34	D100		Brace	180X65X4	No Message	COMDIS9(T)	0.221	0	0.219	0.002
N+5.34	D102	62	Brace	180X65X4	No Message	COMDIS8(C)	0.706	0.02	0.686	0.0001137
N+5.34	D103	64	Brace	180X65X4	No Message	COMDIS9(C)	0.196	0.007	0.189	0.0001964
N+5.34	D103		Brace	180X65X4	No Message	COMDIS11(T)	0.245	0.013	0.232	0.0001752
N+5.34	D107	70	Brace	180X65X4	No Message	COMDIS11(C)	0.706	0.016	0.689	0.001
N+5.34	D107		Brace	180X65X4	No	COMDIS9(T)	0.366	0.0003923	0.365	0.001

Story	Label	Unique Name	Design Type	Design Section	Status	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio
					Message					
N+5.34	D109	74	Brace	180X55X4	No Message	COMDIS8(C)	0.748	0.054	0.693	0.001
N+5.34	D110	76	Brace	180X55X4	No Message	COMDIS9(C)	0.122	0.004	0.116	0.002
N+5.34	D110		Brace	180X55X4	No Message	COMDIS11(T)	0.155	0.007	0.147	0.001
N+5.34	D114	82	Brace	180X55X4	No Message	COMDIS11(C)	0.471	0.017	0.453	0.002
N+5.34	D116	85	Brace	180X55X4	No Message	COMDIS8(C)	0.408	0.017	0.39	0.001
N+5.34	D116		Brace	180X55X4	No Message	COMDIS11(T)	0.264	0.002	0.26	0.002
N+3.95	D82	48	Brace	180X55X4	No Message	COMDIS9(C)	0.093	0.006	0.085	0.001
N+3.95	D82		Brace	180X55X4	No Message	COMDIS11(T)	0.113	0.006	0.105	0.002
N+3.95	D90	54	Brace	180X55X4	No Message	COMDIS11(C)	0.111	0.005	0.105	0.002
N+3.95	D90		Brace	180X55X4	No Message	COMDIS8(T)	0.154	0.006	0.146	0.002
N+3.95	D91	55	Brace	180X55X4	No Message	COMDIS8(C)	0.482	0.013	0.466	0.002
N+3.95	D101	61	Brace	180X55X4	No Message	COMDIS9(C)	0.157	0.011	0.145	0.0001535
N+3.95	D101		Brace	180X55X4	No Message	COMDIS11(T)	0.191	0.013	0.178	0.000147
N+3.95	D104	67	Brace	180X55X4	No Message	COMDIS11(C)	0.196	0.009	0.186	0.001
N+3.95	D104		Brace	180X55X4	No Message	COMDIS8(T)	0.27	0.013	0.256	0.001
N+3.95	D105	68	Brace	180X55X4	No Message	COMDIS8(C)	0.829	0.017	0.812	0.0001561
N+3.95	D108	73	Brace	180X55X4	No Message	COMDIS9(C)	0.099	0.006	0.091	0.002
N+3.95	D108		Brace	180X55X4	No Message	COMDIS11(T)	0.122	0.007	0.114	0.001
N+3.95	D111	79	Brace	180X55X4	No Message	COMDIS11(C)	0.191	0.008	0.181	0.001
N+3.95	D111		Brace	180X55X4	No Message	COMDIS8(T)	0.259	0.011	0.246	0.002
N+3.95	D112	80	Brace	180X55X4	No Message	COMDIS8(C)	0.865	0.045	0.819	0.001
N+3.95	D118	87	Brace	180X55X4	No Message	COMDIS11(C)	0.101	0.003	0.095	0.002
N+3.95	D118		Brace	180X55X4	No Message	COMDIS8(T)	0.151	0.006	0.143	0.001
N+3.95	D119	88	Brace	180X55X4	No Message	COMDIS8(C)	0.476	0.014	0.461	0.002
N+3.95	D119		Brace	180X55X4	No Message	COMDIS11(T)	0.289	0.001	0.286	0.001

Table 1.5 - Steel Frame Summary - AISC 360-10 (Part 2 of 2)

Story	Label	Unique Name	V Major Combo	V Major Ratio	V Minor Combo	V Minor Ratio
N+5.34	C20-1	52	COMDIS3	0.005	COMDIS10	0.028
N+5.34	C20-1					
N+5.34	C28	59	COMDIS3	0.012	COMDIS8	0.026
N+5.34	C28					
N+5.34	C21-1	65	COMDIS3	0.006	COMDIS10	0.046
N+5.34	C21-1					
N+5.34	C29	72	COMDIS3	0.013	COMDIS8	0.042
N+5.34	C29					
N+5.34	C22-1	77	COMDIS3	0.005	COMDIS4	0.048
N+5.34	C22-1					
N+5.34	C30	84	COMDIS3	0.014	COMDIS8	0.036
N+5.34	C31	90	COMDIS3	0.012	COMDIS8	0.02
N+5.34	C31					
N+3.95	C20	50	COMDIS3	0.007	COMDIS10	0.028
N+3.95	C20					

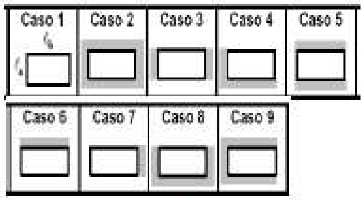
Story	Label	Unique Name	V Major Combo	V Major Ratio	V Minor Combo	V Minor Ratio
N+3.95	C21	63	COMDIS3	0.013	COMDIS10	0.046
N+3.95	C21					
N+3.95	C22	75	COMDIS3	0.007	COMDIS4	0.05
N+3.95	C22					
N+3.95	C3-2	53	COMDIS5	0.008	COMDIS4	0.028
N+3.95	C3-2					
N+3.95	C28	58	COMDIS3	0.012	COMDIS8	0.026
N+3.95	C28					
N+3.95	C6-1	66	COMDIS5	0.01	COMDIS4	0.049
N+3.95	C6-1					
N+3.95	C29	71	COMDIS3	0.013	COMDIS8	0.042
N+3.95	C9-1	78	COMDIS3	0.01	COMDIS8	0.057
N+3.95	C9-1					
N+3.95	C30	83	COMDIS3	0.014	COMDIS8	0.036
N+3.95	C12-1	86	COMDIS3	0.008	COMDIS8	0.021
N+3.95	C12-1					
N+3.95	C31	89	COMDIS3	0.012	COMDIS8	0.02
N+3.95	C31					
N+5.93	B12	102	COMDIS1	0.002	COMDIS3	0.001
N+5.93	B12					
N+5.93	B13	103	COMDIS1	0.002	COMDIS3	0.002
N+5.93	B13					
N+5.34	B83	94	COMDIS8	0.003	COMDIS5	0.001
N+5.34	B83					
N+5.34	B84	95	COMDIS4	0.002	COMDIS3	0.001
N+5.34	B84					
N+5.34	B85	96	COMDIS8	0.003	COMDIS3	0.001
N+5.34	B85					
N+5.34	B86	97	COMDIS8	0.004	COMDIS3	0.001
N+5.34	B86					
N+5.34	B87	98	COMDIS8	0.004	COMDIS3	0.001
N+5.34	B87					
N+5.34	B93	106	COMDIS3	0.004	COMDIS3	0.002
N+5.34	B94	107	COMDIS3	0.004	COMDIS3	0.002
N+5.34	B95	108	COMDIS3	0.004	COMDIS3	0.003
N+3.45	B79	60	COMDIS11	0.008	COMDIS3	0.009
N+3.45	B79					
N+3.45	B80	91	COMDIS11	0.012	COMDIS3	0.012
N+3.45	B80					
N+3.45	B81	92	COMDIS11	0.011	COMDIS3	0.012
N+3.45	B81					
N+3.45	B82	93	COMDIS8	0.007	COMDIS3	0.01
N+3.45	B82					
N+3.45	B88	99	COMDIS1	0.003	COMDIS3	0.003
N+3.45	B88					
N+3.45	B89	100	COMDIS1	0.002	COMDIS3	0.003
N+3.45	B89					
N+3.45	B90	101	COMDIS1	0.002	COMDIS3	0.003
N+3.45	B90					
N+3.45	B91	104	COMDIS1	0.003	COMDIS3	0.002
N+3.45	B91					
N+3.45	B92	105	COMDIS1	0.003	COMDIS3	0.002
N+3.45	B92					
N+3.45	B96	109	COMDIS8	0.005	COMDIS3	0.005
N+3.45	B96					
N+3.45	B97	110	COMDIS8	0.008	COMDIS5	0.007
N+3.45	B97					
N+3.45	B98	111	COMDIS8	0.007	COMDIS3	0.005
N+3.45	B98					
N+5.93	D92	56	COMDIS11	0.018	COMDIS3	0.004

Story	Label	Unique Name	V Major Combo	V Major Ratio	V Minor Combo	V Minor Ratio
N+5.93	D106	69	COMDIS11	0.034	COMDIS3	0.007
N+5.93	D113	81	COMDIS11	0.019	COMDIS3	0.005
N+5.34	D87	49	COMDIS8	0.04	COMDIS3	0.009
N+5.34	D88	51	COMDIS11	0.018	COMDIS3	0.004
N+5.34	D88					
N+5.34	D100	57	COMDIS11	0.038	COMDIS3	0.005
N+5.34	D100					
N+5.34	D102	62	COMDIS8	0.071	COMDIS3	0.01
N+5.34	D103	64	COMDIS11	0.032	COMDIS3	0.007
N+5.34	D103					
N+5.34	D107	70	COMDIS11	0.064	COMDIS3	0.005
N+5.34	D107					
N+5.34	D109	74	COMDIS8	0.071	COMDIS3	0.01
N+5.34	D110	76	COMDIS11	0.02	COMDIS3	0.004
N+5.34	D110					
N+5.34	D114	82	COMDIS11	0.041	COMDIS3	0.005
N+5.34	D116	85	COMDIS8	0.04	COMDIS3	0.009
N+5.34	D116					
N+3.95	D82	48	COMDIS11	0.016	COMDIS3	0.004
N+3.95	D82					
N+3.95	D90	54	COMDIS8	0.021	COMDIS3	0.006
N+3.95	D90					
N+3.95	D91	55	COMDIS8	0.042	COMDIS3	0.012
N+3.95	D101	61	COMDIS11	0.029	COMDIS3	0.005
N+3.95	D101					
N+3.95	D104	67	COMDIS8	0.036	COMDIS3	0.008
N+3.95	D104					
N+3.95	D105	68	COMDIS8	0.075	COMDIS3	0.015
N+3.95	D108	73	COMDIS11	0.018	COMDIS3	0.004
N+3.95	D108					
N+3.95	D111	79	COMDIS8	0.035	COMDIS3	0.008
N+3.95	D111					
N+3.95	D112	80	COMDIS8	0.075	COMDIS3	0.015
N+3.95	D118	87	COMDIS8	0.02	COMDIS3	0.006
N+3.95	D118					
N+3.95	D119	88	COMDIS8	0.042	COMDIS3	0.012
N+3.95	D119					

7.5.1 DISEÑO PLACA MACIZA

PROYECTO: MARIA INMACULADA
DISEÑO PLACA MACIZA TANQUE

El diseño de la placa maciza se realiza de acuerdo con lo establecido en C.13.9 de las NSR - 10



Geometría de la losa

la =	4,87	m	fy =	420	MPa
lb =	5,86	m	f'c =	21,1	MPa
Relación m =	0,83				

Espesor escogido: 0,15 m

Teniendo en cuenta que la relación m es mayor de 0.5, la placa maciza trabaja en dos direcciones

Cargas

Peso propio de la losa	0.15x1.0x24	3,60	kN/m²
Muros divisorios		2,00	kN/m²
Acabados	0.05x20	1,10	kN/m²
Carga Muerta Total		6,70	kN/m²
Carga Viva		5,00	kN/m²
Carga Última		16,04	kN/m²

Tipo de soporte CASO Nº 6

DISEÑO A MOMENTO FLECTOR

Coeficientes para momento positivo por carga muerta y viva:

C_{ab} = 0,056
C_{bb} = 0,006
C_{av} = 0,068
C_{bv} = 0,008

Mu_a =	**16,96**	kN.m	*Cuantía:*	0,0029	*As =*	3,48 cm²/m
Mu_b =	**2,75**	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m

Coeficientes para momento negativo por carga última:

C_a =	0,095	Mu_a =	**36,14**	kN.m	*Cuantía:*	0,0065	*As =*	7,76 cm²/m
C_b =	0,000	Mu_b =	**0,00**	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m

Distribución de refuerzo inferior:

Sentido La *1#4c/0.2*

Sentido Lb *1#4c/0.2*

Distribución de refuerzo superior:

Sentido La *1#4c/0.2*

Sentido Lb *1#4c/0.2*

REVISIÓN A CORTANTE

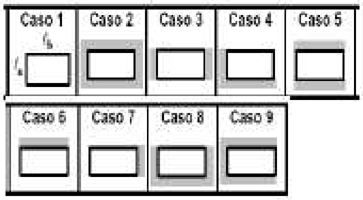
Coeficientes de relación de carga en las dos direcciones para cortante:

W_a = 0,95
W_b = 0,05

ϕvc =	**0,574**	**MPa**	
ϕvu_a =	**0,298**	**MPa**	**OK**
ϕvu_b =	**0,013**	**MPa**	**OK**

PROYECTO: MARIA INMACULADA
DISEÑO PLACA MACIZA TANQUE

El diseño de la placa maciza se realiza de acuerdo con lo establecido en C.13.9 de las NSR - 10



Geometría de la losa

la =	3,60	m	fy =	420	MPa
lb =	4,87	m	f'c =	21,1	MPa

Relación m = **0,74**

Espesor escogido: **0,15** **m**

Teniendo en cuenta que la relación m es mayor de 0.5, la placa maciza trabaja en dos direcciones

Cargas

Peso propio de la losa	0.15x1.0x24	3,60	kN/m²
Muros divisorios		2,00	kN/m²
Acabados	0.05x20	1,10	kN/m²
Carga Muerta Total		6,70	kN/m²
Carga Viva		5,00	kN/m²
Carga Última		16,04	kN/m²

Tipo de soporte CASO Nº 6

DISEÑO A MOMENTO FLECTOR

Coeficientes para momento positivo por carga muerta y viva:

C_{aD} = 0,056
C_{bD} = 0,006
C_{av} = 0,068
C_{bv} = 0,008

Mu_a =	9,27	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m
Mu_b =	1,90	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m

Coeficientes para momento negativo por carga última:

C_a =	0,095	Mu_a =	19,75	kN.m	*Cuantía:*	0,0034	*As =*	4,08 cm²/m
C_b =	0,000	Mu_b =	0,00	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m

Distribución de refuerzo inferior:

Sentido La *1#4c/0.2*

Sentido Lb *1#4c/0.2*

Distribución de refuerzo superior:

Sentido La *1#4c/0.2*

Sentido Lb *1#4c/0.2*

REVISIÓN A CORTANTE

Coeficientes de relación de carga en las dos direcciones para cortante:

W_a = 0,95
W_b = 0,05

ϕvc =	**0,574**	**MPa**	
ϕvu_a =	**0,247**	**MPa**	**OK**
ϕvu_b =	**0,010**	**MPa**	**OK**

7.5.2 DISEÑO DE UNIONES DE ELEMENTOS METALICOS-CONCRETO TER

DISEÑO DE UNIONES DE ELEMENTOS METÀLICOS-CONCRETO
TER

CARGAS

P=	188,56	kN		
M33=	30,61	kN.m		
M22=	30,23	kN.m		
V22=	18,66	kN		
V33=	30,32	kN		

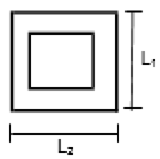
DATOS DEL PERFIL

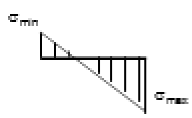
H=	0,18	m.
B=	0,07	m.

MATERIALES

f'c=	21000	kN/m²		
fy=	252000	kN/m²	platina	A36
fy=	735000	kN/m²	pernos	B-7
ex=	0,162	m		

1. DIMENSIONAMIENTO EN PLANTA DE LA PLATINA





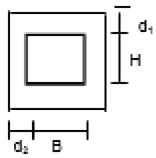
f'c >= Esfuerzo sobre la platina σ_h

L_1(asumido)= 0,23 m.

σ_h = P / L² = L_2(asumido)= 0,30 m.

σ_{mn} =	-1886,94	kN/m	OK.	σ_{med} =	891,908
σ_{max} =	3526,59	kN/m	OK.		

2. ESPESOR DE LA PLATINA

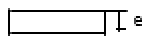


Datos del perfil:

H= 0,18 m
B= 0,07 m
d_1 = 0,025 m
d_2 = 0,122 m

M_1=	0,83 kN.m	V=	64,3 kN
M_2=	4,72 kN.m	V=	77,7 kN

$M_{diseño}$ = 4,72 kN.m



$e_{requerido}$ = 1,06 cm
$e_{colocado}$ = 0,42 pulgadas

Colocar una platina de 230x295x1/2"- Acero A36

3. DISEÑO DE PERNOS

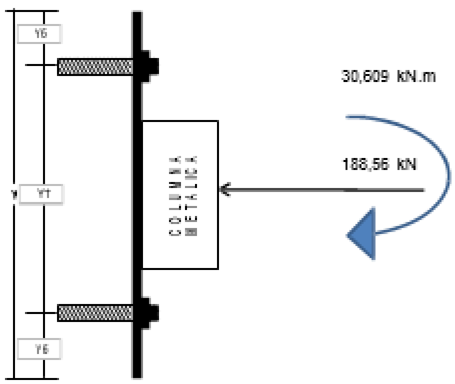
3.1. DISEÑO DE PERNOS EN SENTIDO LONGITUDINAL:

Y1= 0,040 m

Y2= 0,150 m

Y1= 0,040 m

Y= 0,23 m



Número total de anclajes: 4 Und.

CARGA POR CORTANTE:

VR = 35,60 kN

$V_{ANCLAJE}$ = VR / # total de anclajes = 8,90 kN

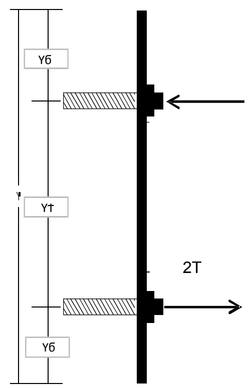
$V_{RESISTENTE}$ = 341,33 kN

CARGA POR COMPRESIÓN:

$P_{ANCLAJE}$ = Pu / # total de anclajes = 47,14 kN

CARGA POR MOMENTO:

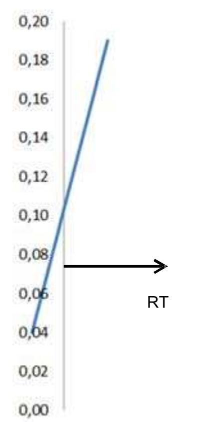
Y1= 0,040 m



σ_{max} = 60770,75 kN/m²

e = 0,16 m

X= 0,10 m



Y1= 0,040 m

Y= 0,23 m

σ_{min} = -44550,54 kN/m²

1 eje de pernos de anclaje trabajan en tensión.

RT_{33} = 690,53 KN

690,53 = 2T

T_{33} = 345,27 kN

As_{33} = 5,219 cm^2 2 Pernos de 7/8"Acero B-7 7,74 cm^2

$T_{RESISTENTE\ 33}$ = 512,00 kN

3.2. DISEÑO DE PERNOS EN SENTIDO TRANSVERSAL:

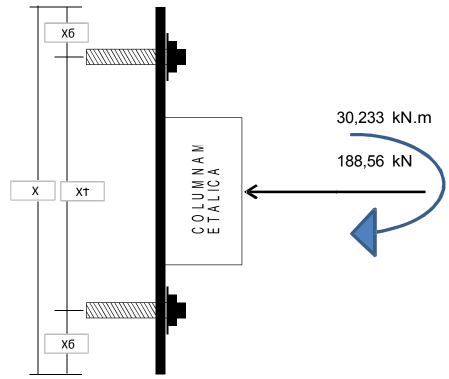
X1= 0,070 m

X2= 0,160 m

X1= 0,070 m

X= 0,30 m

Número total de anclajes: 4 Und.



CARGA POR CORTANTE:

VR = 35,60 kN

$V_{ANCLAJE}$ = VR / # total de anclajes = 8,90 kN

$V_{RESISTENTE}$ = 341,33 kN

CARGA POR COMPRESIÓN:

$P_{ANCLAJE}$ = Pu / # total de anclajes = 47,14 kN

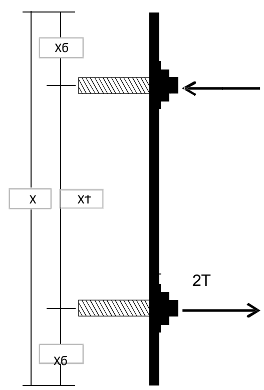
CARGA POR MOMENTO:

X1= 0,070 m

X2= 0,160 m

X1= 0,070 m

X= 0,30 m

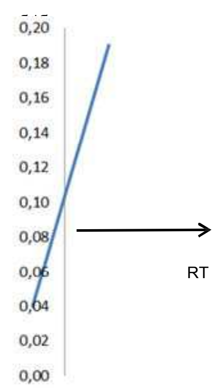


σ_{max} = 58446,01 kN/m²

e = 0,16 m

X= 0,13 m

σ_{min} = -42225,79 kN/m²



1 eje de pernos de anclaje trabajan en tensión.

$RT_{22} =$ 797,00 KN

797,00 = 2T

T_{22} = 398,50 kN

$As_{22} =$ 6,024 cm^2 2 Pernos de 7/8"Acero B-7 7,74 cm^2

$T_{RESISTENTE\ 22} =$ 512,00 kN

$As_{TOTAL} =$ 15,48 cm^2 4 Pernos de 7/8"Acero B-7 15,48 cm^2

$T_{RESISTENTE\ TOTAL} =$ 1024,00 kN

VERIFICACIÓN EFECTOS COMBINADOS:

T ACTUANTE TOTAL = $T_{33} + T_{22}$ = 743,77 kN

$$(T_{ACTUANTE\ TOTAL} / T_{RESISTENTE\ TOTAL})^2 + (V_{ACTUANTE} / V_{RESISTENTE})^2 \leq 6$$

0,53 ≤ 1 OK

DISEÑO DE UNIONES DE ELEMENTOS METÁLICOS-CONCRETO
TER

CARGAS

P=	14,37	kN	
M33=	3,12	kN.m	
M22=	0,96	kN.m	
V22=	1,26	kN	
V33=	4,64	kN	

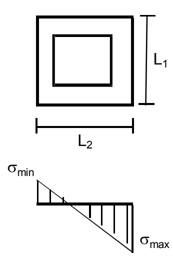
DATOS DEL PERFIL

H=	0,18	m.
B=	0,07	m.

MATERIALES

f'c=	21000	kN/m^2		
fy=	252000	kN/m^2	platina	A36
fy=	735000	kN/m^2	pernos	B-7
ex=	0,217	m		

1. DIMENSIONAMIENTO EN PLANTA DE LA PLATINA



f'c >= Esfuerzo sobre la platina σ_h

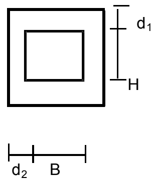
L_1(asumido)= 0,29 m.

$\sigma_h = P / L^2 =$ L_2(asumido)= 0,30 m.

$\sigma_{min} =$ -169,27 kN/m OK. $\sigma_{med} =$ 57,229

$\sigma_{max} =$ 268,37 kN/m OK.

2. ESPESOR DE LA PLATINA

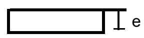


Datos del perfil:

H=	0,18 m
B=	0,07 m
d_1 =	0,055 m
d_2 =	0,122 m

M_1=	0,30 kN.m	V=	12,3 kN
M_2=	0,36 kN.m	V=	5,9 kN

$M_{diseño}$ = 0,36 kN.m



$e_{requerido}$ = 0,29 cm

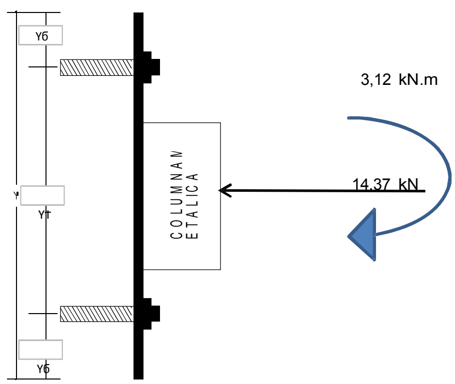
$e_{colocado}$ = 0,12 pulgadas

Colocar una platina de 290x295x1/2"- Acero A36

3. DISEÑO DE PERNOS

3.1. DISEÑO DE PERNOS EN SENTIDO LONGITUDINAL:

Y1=	0,070 m
Y2=	0,150 m
Y1=	0,070 m
Y=	0,29 m



Número total de anclajes: 4 Und.

CARGA POR CORTANTE:

VR = 4,80 kN

$V_{ANCLAJE}$ = VR / # total de anclajes = 1,20 kN

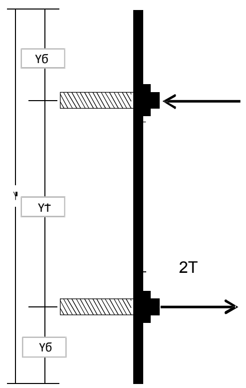
$V_{RESISTENTE}$ = 113,78 kN

CARGA POR COMPRESIÓN:

$P_{ANCLAJE}$ = Pu / # total de anclajes = 3,59 kN

CARGA POR MOMENTO:

Y1= 0,070 m



σ_{max} = 5985,81 kN/m²

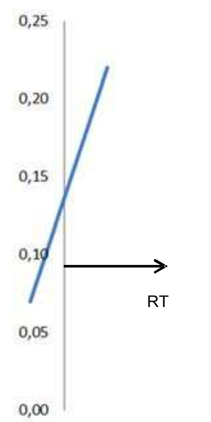
e = 0,22 m

X= 0,14 m

Y1= 0,070 m

Y= 0,29 m

σ_{min} = -4749,68 kN/m²



1 eje de pernos de anclaje trabajan en tensión.

RT_{33} = 103,07 KN

103,07 = 2T

T_{33} = 51,53 kN

As_{33} = 0,779 cm^2 2 Pernos de 1/2"Acero B-7 2,58 cm^2

$T_{RESISTENTE\ 33}$ = 170,67 kN

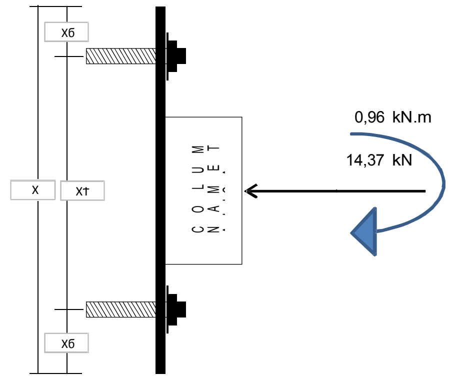
3.2. DISEÑO DE PERNOS EN SENTIDO TRANSVERSAL:

X1= 0,070 m

X2= 0,160 m

X1= 0,070 m

X= 0,30 m



Número total de anclajes: 4 Und.

CARGA POR CORTANTE:

VR = 4,80 kN

$V_{ANCLAJE}$ = VR / # total de anclajes = 1,20 kN

$V_{RESISTENTE}$ = 113,78 kN

CARGA POR COMPRESIÓN:

$P_{ANCLAJE}$ = Pu / # total de anclajes = 3,59 kN

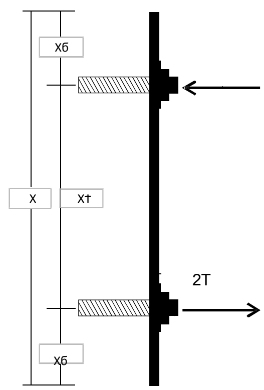
CARGA POR MOMENTO:

X1= 0,070 m

X2= 0,160 m

X1= 0,070 m

X= 0,30 m

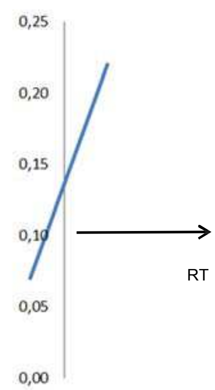


σ_{max} = 2216,40 kN/m²

e = 0,07 m

X= 0,09 m

σ_{min} = -980,27 kN/m²



1 eje de pernos de anclaje trabajan en tensión.

RT_{22} = 13,53 KN

13,53 = 2T

T_{22} = 6,76 kN

As_{22} = 0,102 cm^2 2 Pernos de 1/2"Acero B-7 2,58 cm^2

$T_{RESISTENTE\ 22}$ = 170,67 kN

As_{TOTAL} = 5,16 cm^2 4 Pernos de 1/2"Acero B-7 5,16 cm^2

$T_{RESISTENTE\ TOTAL}$ = 341,33 kN

VERIFICACIÓN EFECTOS COMBINADOS:

T ACTUANTE TOTAL = $T_{33} + T_{22}$ = 58,30 kN

$(T_{ACTUANTE\ TOTAL} / T_{RESISTENTE\ TOTAL})^2 + (V_{ACTUANTE} / V_{RESISTENTE})^2 \leq б$

0,03 ≤ 1 OK

7.6 DISEÑO DE ELEMENTOS NO ESTRUCTURALES

Units: kN*m

STORY DATA

Story	Height	Elevation	SimilarTo
N+3.45	3,5	3,45	None
BASE	0	-0,05	None

CENTER MASS RIGIDITY

Story	Diaphragm	MassX	MassY	XCM	YCM	CumMassX	CumMassY	XCCM	YCCM	XCR	YCR
N+3.45	D1	80,3702	80,3702	9,388	9,062	80,3702	80,3702	9,388	9,062	7,996	7,796

STORY SHEARS

Story	Load	Loc	P	VX	VY	T	MX	MY
N+3.45	SISDISX	Top	0	150,92	27,79	870,549	8,243	25,947
N+3.45	SISDISX	Bottom	0	150,92	27,79	870,549	104,506	530,902
N+3.45	SISDISY	Top	0	27,79	122,31	1902,194	44,401	0,59
N+3.45	SISDISY	Bottom	0	27,79	122,31	1902,194	463,264	97,3

$$F_p = \frac{a_x a_p}{R_p} g M_p \geq \frac{A_a I}{2} g M_p \qquad a_x = \frac{C_{vx} V_s}{m_x g} \leq 2 S_a \qquad C_{vx} = \frac{m_x h_x^k}{\sum_{i=1}^{n} (m_i h_i^k)}$$

$$V_s = S_a g M$$

g: 9,81 m/s^2
Sa: 0,250 s

Grupo de uso: III
Grado de desempeño: SUPERIOR

Grupo de Uso	Grado de desempeño
IV	SUPERIOR
III	SUPERIOR
II	BUENO
I	BAJO

Grado de desempeño de los elementos no estructurales: SUPERIOR

ANALISIS DE CARGAS PARA MUROS

Espesor de muros: 0,15 m
Espesor de pañete en una cara: 0 m
Densidad de mampostería: 13 kN/m3
Densidad mortero de pañete: 21 kN/m3
Altura Fachada: 3,50 m
Carga 6,825 kN/m
Descripción: mampostería reforzada, separada lateralmente de la estructura, apoyada arriba y abajo
ap: 1,0
Rp: 6

ANALISIS DE CARGAS PARA ANTEPECHOS

Espesor de muros: 0,15 m
Espesor de pañete en una cara: 0 m
Densidad de mampostería: 13 kN/m3
Densidad mortero de pañete: 21 kN/m3
Altura Antepecho: 1 m
Carga 1,95 kN/m
Descripción: mampostería reforzada, separada lateralmente de la estructura, apoyada solo abajo
ap: 2,5
Rp: 6

Sección de vigas verticales: 0.15x0.25 m
f'c = 21,1 MPa
fy = 420 MPa

DISEÑO PARA MUROS

Story	Fx	Wx	ax	ap	Rp	Fp	M	V
N+3.45	150,92	80,37	0,500	1,0	6	0,569	0,871	0,995
BASE	-123,13	80,37	-1,532	1,0	6	-1,743	-2,668	-3,050

	Sección Vigas V.			As. (cm2)		Separación column.		Fl. 1/4"
Story	b	d	ρ	neces.	ubicado	S max	$S_{escogida}$	$S_{estribos}$
N+3.45	0.15	0,21	0,00031	0,10	0,71	7,16	7,20	0,188
BASE	0.15	0,21	-0,00095	-0,30	0,71	-2,37	-2,40	0,188

DISEÑO PARA ANTEPECHOS

Story	Fx	Wx	ax	ap	Rp	Fp	M	V
N+3.45	150,92	80,37	0,500	2,5	6	1,422	2,177	2,488
BASE	-123,13	80,37	-1,532	2,5	6	-4,357	-6,671	-7,624

	Sección columneta			As. (cm2)		Separación column.		Fl. 1/4"
Story	b	d	ρ	neces.	ubicado	S max	$S_{escogida}$	$S_{estribos}$
N+3.45	0.15	0,21	0,00079	0,25	1,29	5,18	5,20	0,188
BASE	0.15	0,21	-0,00234	-0,74	1,29	-1,75	-1,80	0,188

8 ESPECIFICACIONES TÉCNICAS

Los materiales utilizados son:

Concreto	21.1 MPa para vigas, placas, zapatas
y columnas. Concreto	14 MPa (para concreto de limpieza).
Acero	para refuerzo fy = 420 MPa para todos los diámetros.
Acero estructural	A36 pernos de anclaje y platinas
Acero estructural	A500 en perfiles metálicos

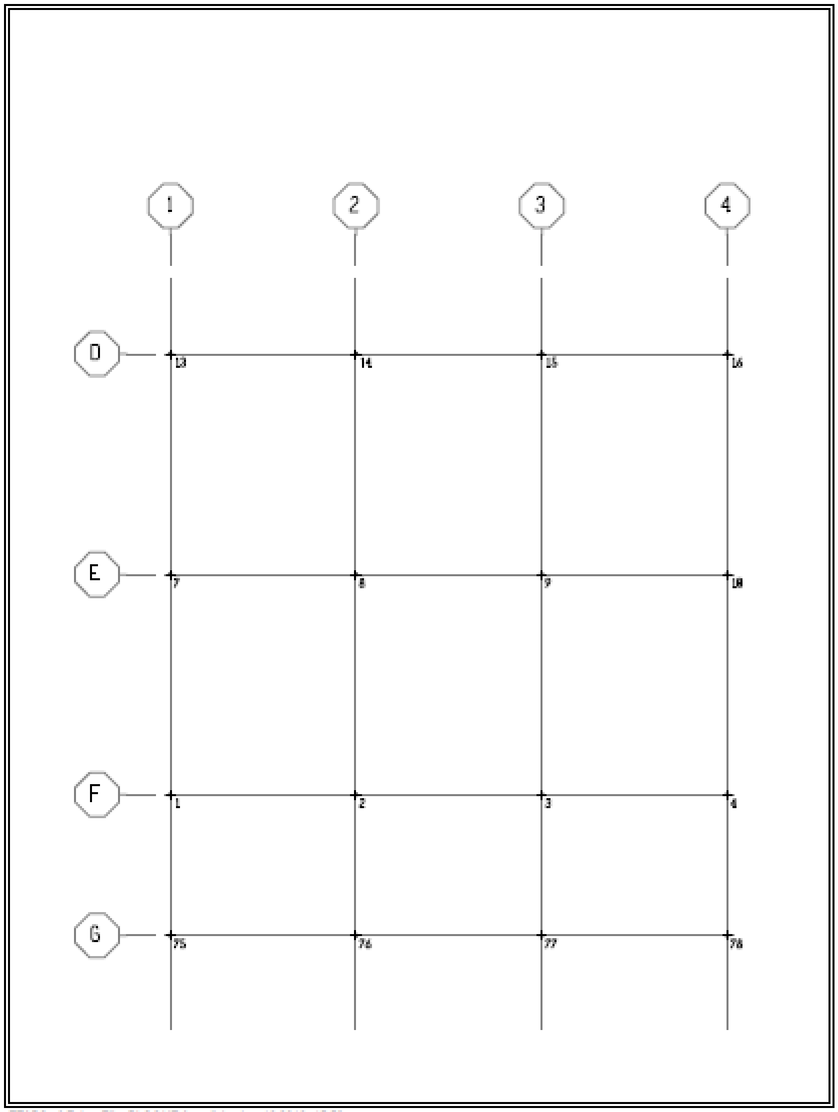
9 CONCLUSIONES Y RECOMENDACIONES

Habiendo finalizado el diseño y análisis estructural de la institución educativa Alfredo Bonilla sede No 2 Maria Inmaculada Grupo 002 basado en la Norma Colombiana de Diseño y Construcción Sismo Resistente Ley 400 de 1997 (Modificada Ley 1229 de 2008) y Decreto 926 de Marzo de 2010, Decreto 092 del 17 de Enero de
2011, Decreto 0340 del 13 de Febrero de 2012 y en el Reglamento para Concreto Estructural ACI 318S-08,
hemos llegado a las siguientes conclusiones y
recomendaciones.

- Se cumplió satisfactoriamente con los objetivos del cálculo y diseño estructural mediante la aplicación de la norma sismo resistente (NSR-10) y el reglamento para concreto estructural ACI 318S-08, además de la ayuda del software ETABS V9.7.4 se puede garantizar el buen funcionamiento de la estructura que presenta una buena respuesta ante un evento sísmico.
- La revisión de los desplazamientos laterales (derivas) de la estructura teniendo en cuenta las direcciones "X" y "y", nos arrojó que los resultados obtenidos son aceptables permitiendo un buen funcionamiento ante la actuación de un sismo y que cumple con lo establecido en la norma sismo resistente (NSR-10).
- En cuanto a la revisión de columnas y vigas determinamos que cumplen con los requisitos, ya que en estructuras de edificios aporticados es obligatorio que los miembros horizontales fallen antes que los verticales, permitiendo de esa manera un retraso del colapso total de la estructura.
- Para la construcción de la estructura se recomienda llevar un estricto control en la calidad de los materiales a utilizar, ya que estos deberán cumplir con requisitos especiales para el buen funcionamiento de la edificación. Además que estos deberán ser supervisados a la hora de la puesta en marcha por el ingeniero residente.

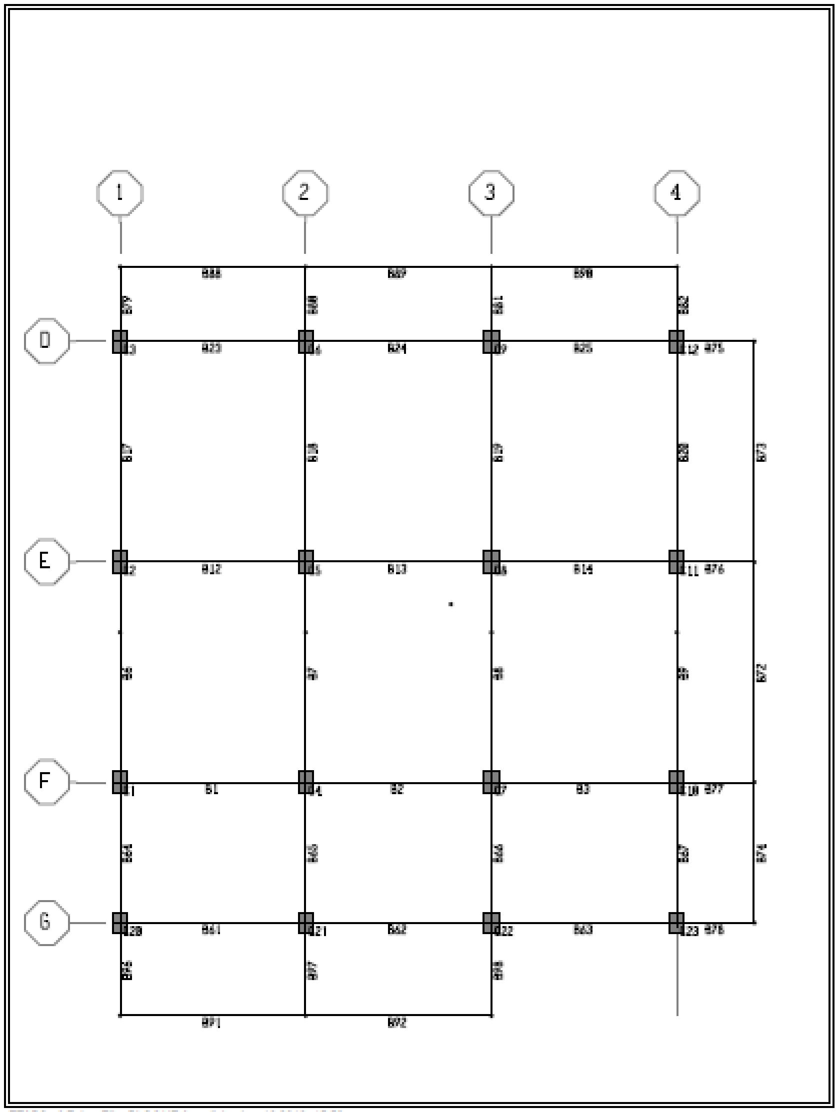
9 ANEXOS

ETABS



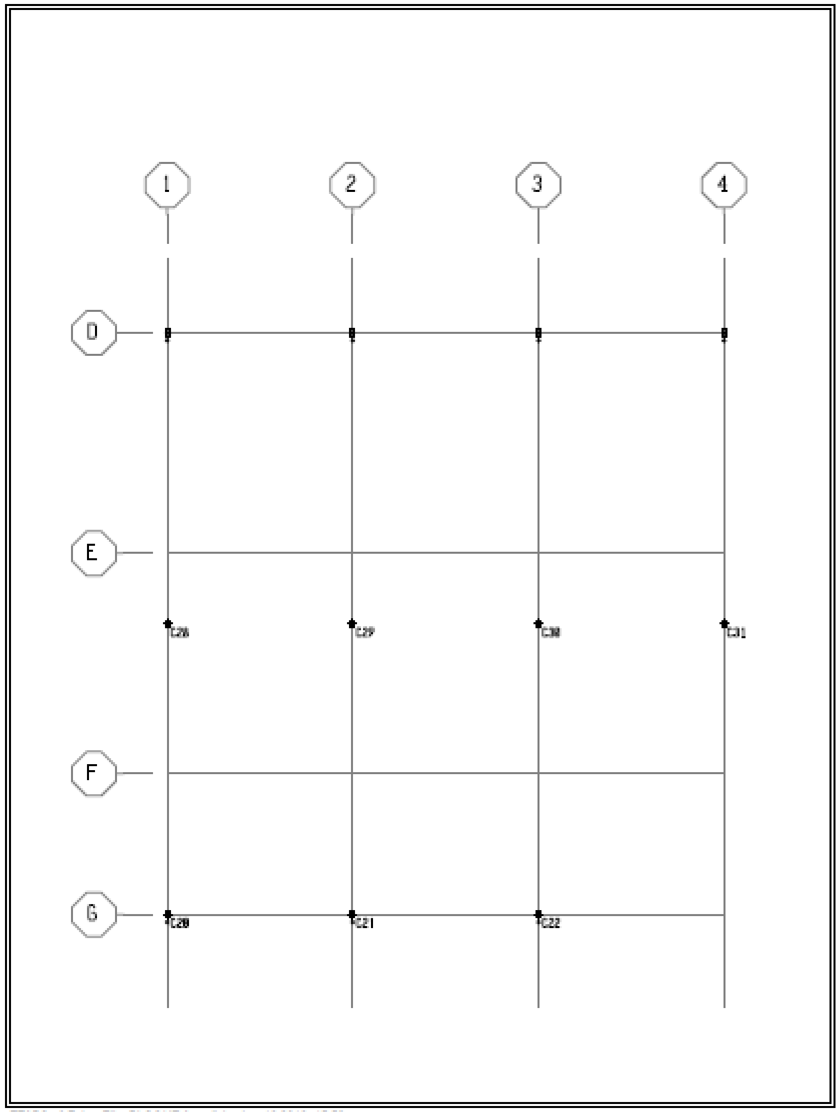
ETABS v9.7.4 - File: BLOQUE A - diciembre 13,2016 15:50
Plan View - BASE - Elevation -0.05 - KN-m Units

ETABS



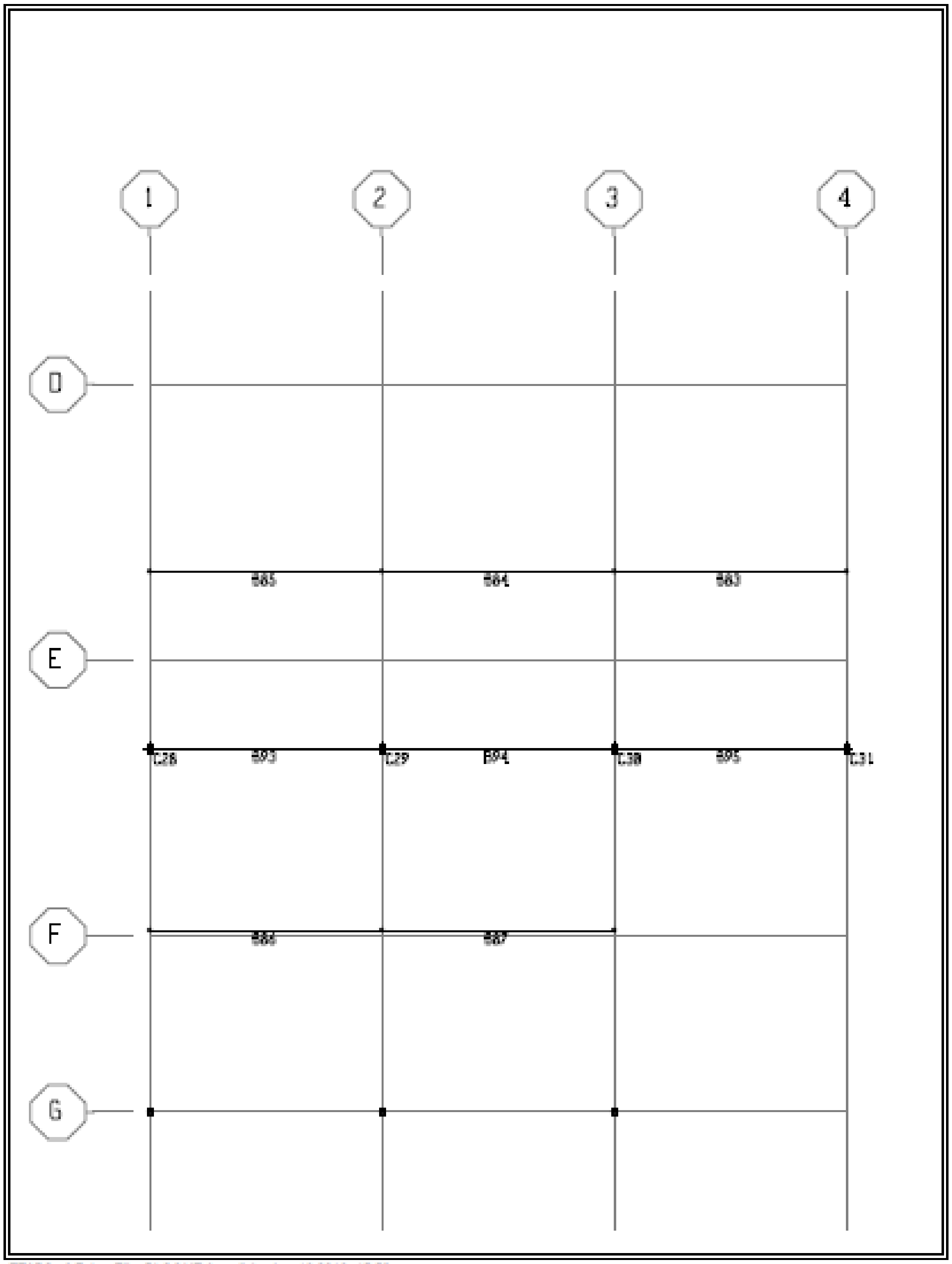
ETABS v9.7.4 - File: BLOQUE A - diciembre 13,2016 15:53
Plan View - N+3.45 - Elevation 3.45 - KN-m Units

ETABS



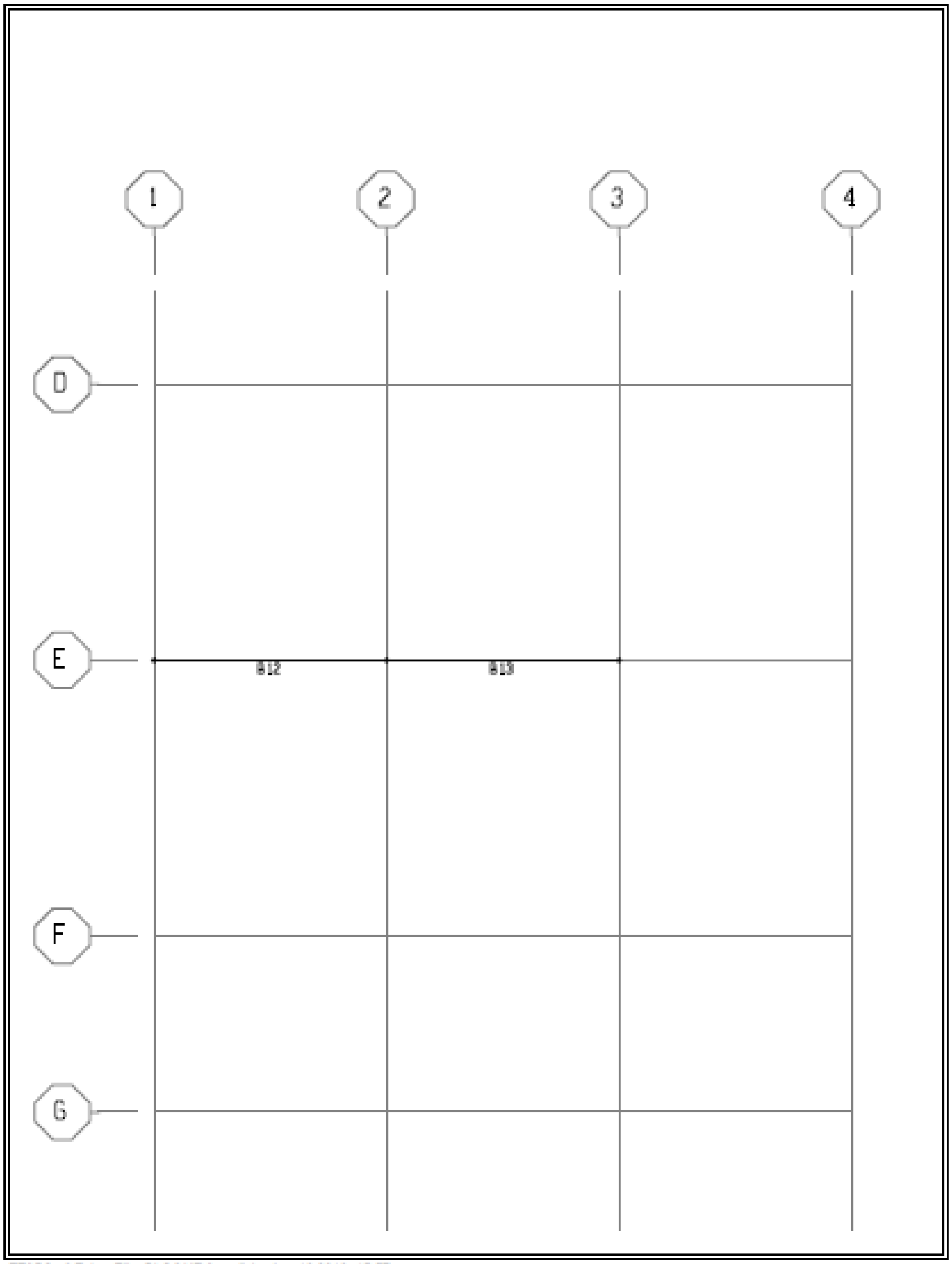
ETABS v9.7.4 - File: BLOQUE A - diciembre 13,2016 15:56
Plan View - N+3.95 - Elevation 4.21 - KN-m Units

ETABS



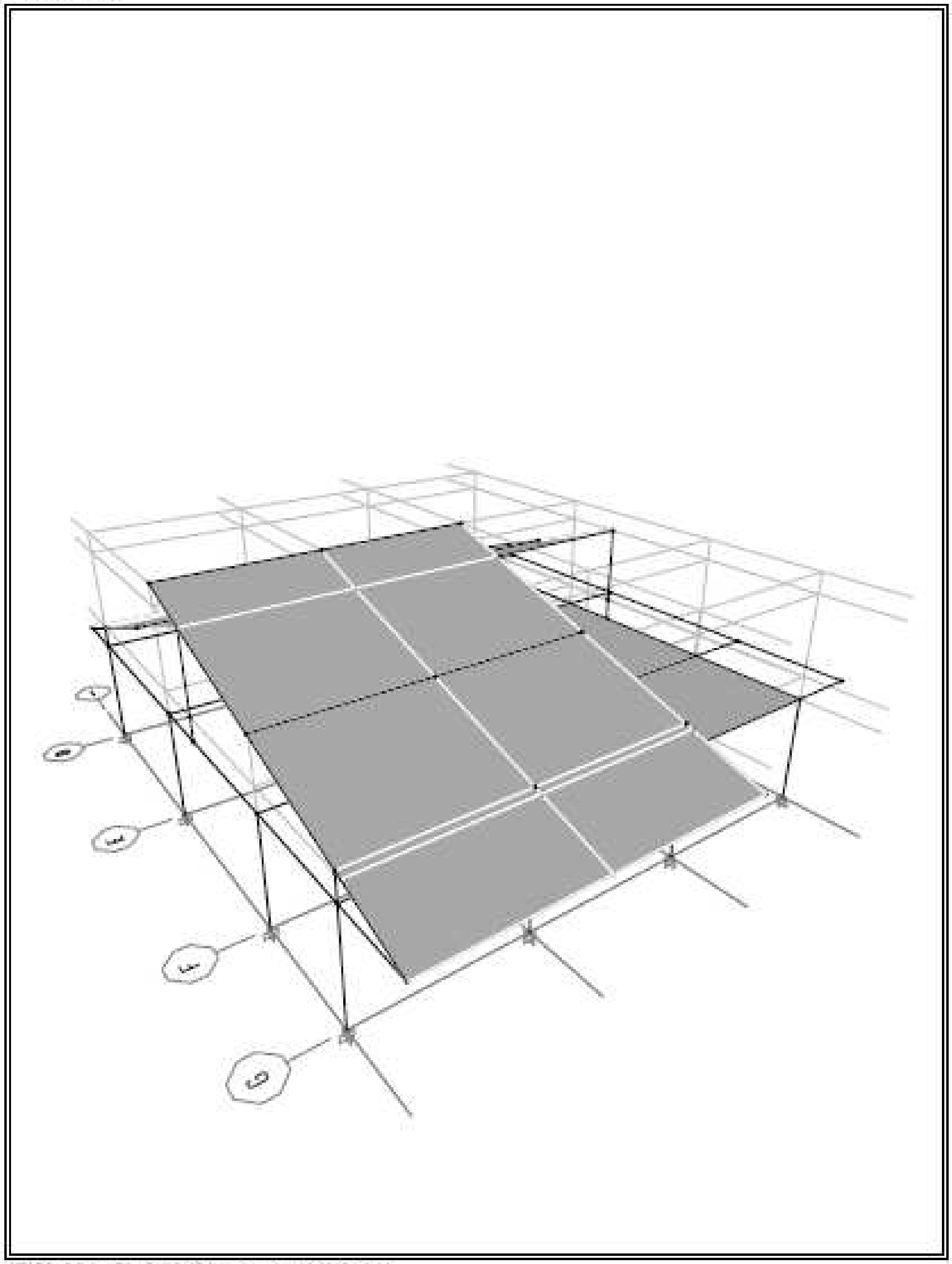
ETABS v9.7.4 - File: BLOQUE A - diciembre 13,2016 15:58
Plan View - N+5.34 - Elevation 6.83 - KN-m Units

ETABS



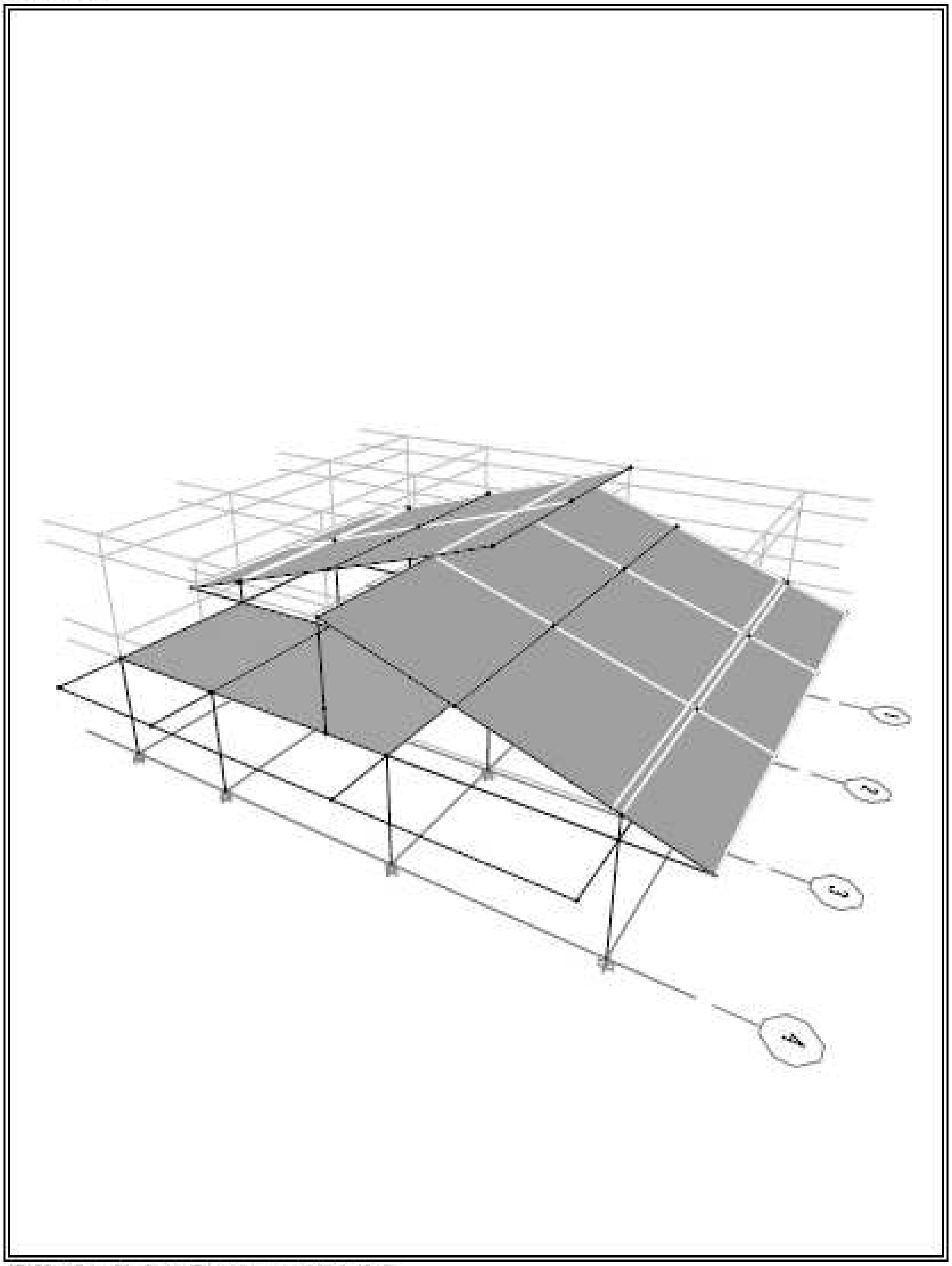
ETABS v9.7.4 - File: BLOQUE A - diciembre 13,2018 15:57
Plan View - N+5.93 - Elevation 7.5 - KN-m Units

ETABS



ETABS v9.7.4 - File: BLOQUE A - diciembre 13,2016 16:14
3-D View - KN-m Units

ETABS



ETABS v9.7 A - File: BLOQUE A - diciembre 15,2016 16:15
3-D View - KN-m Units

9.1 DATOS DE ENTRADA

ETABS v9.7.4 File:BLOQUE A Units:KN-m diciembre 12, 2016 19:12 PAGE 1

S T O R Y   D A T A

STORY	SIMILAR TO	HEIGHT	ELEVATION
N+5.93	None	0.670	7.500
N+5.34	None	2.620	6.830
N+3.95	None	0.760	4.210
N+3.45	None	3.500	3.450
BASE	None		-0.050

ETABS v9.7.4 File:BLOQUE A Units:KN-m diciembre 12, 2016 19:12 PAGE 2

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

POINT	X	Y	DZ-BELOW
1	0.000	4.000	0.000
2	5.270	4.000	0.000
3	10.540	4.000	0.000
4	15.810	4.000	0.000
7	0.000	10.260	0.000
8	5.270	10.260	0.000
9	10.540	10.260	0.000
10	15.810	10.260	0.000
13	0.000	16.520	0.000
14	5.270	16.520	0.000
15	10.540	16.520	0.000
16	15.810	16.520	0.000
75	0.000	0.000	0.000
76	5.270	0.000	0.000
77	10.540	0.000	0.000
78	15.810	0.000	0.000
88	18.010	4.000	0.000
89	18.010	10.260	0.000
90	18.010	16.520	0.000
91	18.010	0.000	0.000
97	0.000	8.260	0.000
99	0.000	-2.640	0.000
100	0.000	-0.219	0.000
102	0.000	18.640	0.000
103	0.000	16.306	0.000
75-1	0.000	0.000	2.551
13-2	0.000	16.520	0.070
112	5.270	-0.219	0.000
113	5.270	16.306	0.000
114	5.270	8.260	0.000
76-1	5.270	0.000	2.551
14-1	5.270	16.520	0.070
115	5.270	-2.640	0.000
116	5.270	18.640	0.000
117	10.540	-0.219	0.000
118	10.540	16.306	0.000
119	10.540	8.260	0.000
77-1	10.540	0.000	2.551
15-1	10.540	16.520	0.070
120	10.540	-2.640	0.000
121	10.540	18.640	0.000
123	15.810	16.306	0.000
124	15.810	8.260	0.000
16-1	15.810	16.520	0.070
126	15.810	18.640	0.000
145	15.810	12.283	0.000
145-1	15.810	12.283	1.310
146	10.540	12.283	0.000
146-1	10.540	12.283	1.310
147	5.270	12.283	0.000
147-1	5.270	12.283	1.310
148	0.000	12.283	0.000
148-1	0.000	12.283	1.310
149	0.000	4.130	0.000
149-1	0.000	4.130	1.276
150	5.270	4.130	0.000
150-1	5.270	4.130	1.276
151	10.540	4.130	0.000
151-1	10.540	4.130	1.276

ETABS v9.7.4 File:BLOQUE A Units:KN-m diciembre 12, 2016 19:12 PAGE 3

C O L U M N   C O N N E C T I V I T Y   D A T A

COLUMN	I END PT	J END PT	I END STORY
C1	1	1	Below
C2	7	7	Below
C3	13	13	Below
C4	2	2	Below
C5	8	8	Below
C6	14	14	Below
C7	3	3	Below
C8	9	9	Below
C9	15	15	Below
C10	4	4	Below
C11	10	10	Below
C12	16	16	Below
C20	75	75	Below
C21	76	76	Below
C22	77	77	Below
C23	78	78	Below
C20-1	75	75-1	Below
C3-2	13	13-2	Below
C28	97	97	Below
C21-1	76	76-1	Below
C6-1	14	14-1	Below
C29	114	114	Below
C22-1	77	77-1	Below
C9-1	15	15-1	Below
C30	119	119	Below
C12-1	16	16-1	Below
C31	124	124	Below

ETABS v9.7.4 File:BLOQUE A Units:KN-m diciembre 12, 2016 19:12 PAGE 4

B E A M   C O N N E C T I V I T Y   D A T A

BEAM	I END PT	J END PT
B1	1	2
B2	2	3
B3	3	4
B6	1	7
B7	2	8
B8	3	9
B9	4	10
B12	7	8
B13	8	9
B14	9	10
B17	7	13
B18	8	14
B19	9	15
B20	10	16
B23	13	14
B24	14	15
B25	15	16
B61	75	76
B62	76	77
B63	77	78
B64	75	1
B65	76	2
B66	77	3
B67	78	4
B72	88	89
B73	89	90
B74	91	88
B75	16	90
B76	10	89
B77	4	88
B78	78	91
B79	13	102
B80	14	116
B81	15	121
B82	126	16
B83	146-1	145-1
B84	147-1	146-1

B85	148-1	147-1
B86	149-1	150-1
B87	150-1	151-1
B88	102	116
B89	116	121
B90	121	126
B91	99	115
B92	115	120
B93	97	114
B94	114	119
B95	119	124
B96	99	75
B97	115	76
B98	120	77

ETABS v9.7.4 File:BLOQUE A Units:KN-m diciembre 12, 2016 19:12 PAGE 5

B R A C E   C O N N E C T I V I T Y   D A T A

BRACE	I END PT	J END PT	I END STORY
D82	99	100	Below
D87	103	97	Below
D88	100	75-1	Below
D90	102	13-2	Below
D91	13-2	103	Same
D92	97	7	Below
D100	75-1	97	Same
D101	115	112	Below
D102	113	114	Below
D103	112	76-1	Below
D104	116	14-1	Below
D105	14-1	113	Same
D106	114	8	Below
D107	76-1	114	Same
D108	120	117	Below
D109	118	119	Below
D110	117	77-1	Below
D111	121	15-1	Below
D112	15-1	118	Same
D113	119	9	Below
D114	77-1	119	Same
D116	123	124	Below
D118	126	16-1	Below
D119	16-1	123	Same

ETABS v9.7.4 File:BLOQUE A Units:KN-m diciembre 12, 2016 19:12 PAGE 6

R I G I D   D I A P H R A G M   P O I N T   C O N N E C T I V I T Y   D A T A

STORY	DIAPHRAGM	POINT	POINT	POINT	POINT	POINT
N+3.45	D1	1	2	3	4	7
		8	9	10	13	14
		15	16			

ETABS v9.7.4 File:BLOQUE A Units:KN-m diciembre 12, 2016 19:12 PAGE 7

M A T E R I A L   P R O P E R T Y   D A T A

MATERIAL NAME	MATERIAL TYPE	DESIGN TYPE	MATERIAL DIR/PLANE	MODULUS OF ELASTICITY	POISSON'S RATIO	THERMAL COEFF	SHEAR MODULUS
STEEL	Iso	Steel	All	199947978.80	0.3000	1.1700E-05	76903068.77
CONC21	Iso	Concrete	All	21538000.000	0.2000	9.9000E-06	8974166.667
OTHER	Iso	None	All	199947978.80	0.3000	1.1700E-05	76903068.77
A500	Iso	Steel	All	199900000.00	0.3000	1.1700E-05	76884615.38
CUB	Iso	Concrete	All	0.000	0.2000	9.9000E-06	0.000

M A T E R I A L   P R O P E R T Y   M A S S   A N D   W E I G H T

MATERIAL NAME	MASS PER UNIT VOL	WEIGHT PER UNIT VOL
STEEL	7.8271E+00	7.6820E+01
CONC21	2.4000E+00	2.4000E+01

OTHER	7.8271E+00	7.6820E+01
A500	7.8271E+00	7.6820E+01
CUB	2.4000E+00	0.0000E+00

M A T E R I A L   D E S I G N   D A T A   F O R   S T E E L   M A T E R I A L S

MATERIAL NAME	STEEL FY	STEEL FU	STEEL COST ($)
STEEL	344737.894	448159.263	271447.16
A500	352000.000	400000.000	5000.00

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

MATERIAL NAME	LIGHTWEIGHT CONCRETE	CONCRETE FC	REBAR FY	REBAR FYS	LIGHTWT REDUC FACT
CONC21	No	21000.000	420000.000	420000.000	N/A
CUB	No	21000.000	420000.000	420000.000	N/A

ETABS v9.7.4 File:BLOQUE A Units:KN-m diciembre 12, 2016 19:12 PAGE 8

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

FRAME SECTION NAME	MATERIAL NAME	SECTION SHAPE NAME OR NAME IN SECTION DATABASE FILE	CONC COL	CONC BEAM
VIG40X45	CONC21	Rectangular		Yes
VIG20X45	CONC21	Rectangular		Yes
COL40X60	CONC21	Rectangular	Yes	
VIG30X45	CONC21	Rectangular		Yes
180X65X4	A500	Box/Tube		
PERFILCOL	A500	Box/Tube		

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

FRAME SECTION NAME	SECTION DEPTH	FLANGE WIDTH TOP	FLANGE THICK TOP	WEB THICK	FLANGE WIDTH BOT	FLANGE THICK BOT
VIG40X45	0.4500	0.4000	0.0000	0.0000	0.0000	0.0000
VIG20X45	0.4500	0.2000	0.0000	0.0000	0.0000	0.0000
COL40X60	0.4000	0.6000	0.0000	0.0000	0.0000	0.0000
VIG30X45	0.4500	0.3000	0.0000	0.0000	0.0000	0.0000
180X65X4	0.1800	0.0650	0.0040	0.0040	0.0000	0.0000
PERFILCOL	0.1000	0.2000	0.0040	0.0040	0.0000	0.0000

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

FRAME SECTION NAME	SECTION AREA	TORSIONAL CONSTANT	MOMENTS OF INERTIA I33	I22	SHEAR AREAS A2	A3
VIG40X45	0.1800	0.0045	0.0030	0.0024	0.1500	0.1500
VIG20X45	0.0900	0.0009	0.0015	0.0003	0.0750	0.0750
COL40X60	0.2400	0.0075	0.0032	0.0072	0.2000	0.2000
VIG30X45	0.1350	0.0024	0.0023	0.0010	0.1125	0.1125
180X65X4	0.0019	0.0000	0.0000	0.0000	0.0014	0.0005
PERFILCOL	0.0023	0.0000	0.0000	0.0000	0.0008	0.0016

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

FRAME SECTION NAME	SECTION MODULI S33	S22	PLASTIC MODULI Z33	Z22	RADIUS OF GYRATION R33	R22
VIG40X45	0.0135	0.0120	0.0203	0.0180	0.1299	0.1155
VIG20X45	0.0068	0.0030	0.0101	0.0045	0.1299	0.0577
COL40X60	0.0160	0.0240	0.0240	0.0360	0.1155	0.1732
VIG30X45	0.0101	0.0068	0.0152	0.0101	0.1299	0.0866
180X65X4	0.0001	0.0000	0.0001	0.0001	0.0626	0.0278
PERFILCOL	0.0001	0.0001	0.0001	0.0002	0.0424	0.0729

F R A M E   S E C T I O N   W E I G H T S   A N D   M A S S E S

FRAME SECTION NAME	TOTAL WEIGHT	TOTAL MASS
VIG40X45	596.6784	59.6678
VIG20X45	35.6832	3.5683
COL40X60	322.5600	32.2560
VIG30X45	0.0000	0.0000
180X65X4	26.1703	2.6665
PERFILCOL	3.3679	0.3432

C O N C R E T E   C O L U M N   D A T A

FRAME SECTION NAME	REINF CONFIGURATION LONGIT	LATERAL	REINF SIZE/TYPE	NUM BARS 3DIR/2DIR	NUM BARS CIRCULAR	BAR COVER
COL40X60	Rectangular	Ties	#9/Design	3/3	N/A	0.0457

C O N C R E T E   B E A M   D A T A

FRAME SECTION NAME	TOP COVER	BOT COVER	TOP LEFT AREA	TOP RIGHT AREA	BOT LEFT AREA	BOT RIGHT AREA
VIG40X45	0.0500	0.0500	0.000	0.000	0.000	0.000
VIG20X45	0.0500	0.0500	0.000	0.000	0.000	0.000
VIG30X45	0.0450	0.0450	0.000	0.000	0.000	0.000

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

SHELL SECTION	MATERIAL NAME	SHELL TYPE	LOAD DIST ONE WAY	MEMBRANE THICK	BENDING THICK	TOTAL WEIGHT	TOTAL MASS
CUBLIV	CONC21	Membrane	Yes	0.0130	0.0130	0.0000	0.0000
CUBMACTAN2	CONC21	Membrane	No	0.1960	0.1960	254.3462	25.4346
CUB	CUB	Membrane	Yes	0.0130	0.0130	0.0000	9.8312

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

STATIC CASE	CASE TYPE	AUTO LAT LOAD	SELF WT MULTIPLIER	NOTIONAL FACTOR	NOTIONAL DIRECTION
DEAD	DEAD	N/A	1.0000		
LIVE	LIVE	N/A	0.0000		
VIENTO	WIND	None	0.0000		

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R E S P O N S E   S P E C T R U M   C A S E S

RESP SPEC CASE: SISDERX

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0500	0.0000	0.0500

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	DERIVAS	9.8100
U2	----	N/A
UZ	----	N/A

RESP SPEC CASE: SISDERY

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0500	0.0000	0.0500

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	----	N/A
U2	DERIVAS	9.8100
UZ	----	N/A

RESP SPEC CASE: SISDISX

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0500	0.0000	0.0500

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	DISENO	9.8100
U2	----	N/A
UZ	----	N/A

RESP SPEC CASE: SISDISY

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0500	0.0000	0.0500

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	----	N/A
U2	DISENO	9.8100
UZ	----	N/A

RESP SPEC CASE: SISUMBX

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0200	0.0000	0.0200

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	UMBRAL	11.4780
U2	----	N/A
UZ	----	N/A

RESP SPEC CASE: SISUMBY

BASIC RESPONSE SPECTRUM DATA

MODAL	DIRECTION	MODAL	SPECTRUM	TYPICAL

COMBO	COMBO	DAMPING	ANGLE	ECCEN
SRSS	SRSS	0.0200	0.0000	0.0200

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	----	N/A
U2	UMBRAL	15.1160
UZ	----	N/A

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L O A D I N G C O M B I N A T I O N S

COMBO	COMBO TYPE	CASE	CASE TYPE	SCALE FACTOR
CIM1	ADD	DEAD	Static	1.0000
		LIVE	Static	1.0000
COMDIS1	ADD	DEAD	Static	1.4000
COMDIS2	ADD	DEAD	Static	1.2000
		LIVE	Static	1.6000
COMDIS3	ADD	DEAD	Static	1.2000
		LIVE	Static	1.0000
		SISDISX	Spectra	1.0000
		SISDISY	Spectra	0.3000
COMDIS4	ADD	DEAD	Static	1.2000
		LIVE	Static	1.0000
		SISDISX	Spectra	0.3000
		SISDISY	Spectra	1.0000
COMDIS5	ADD	DEAD	Static	0.9000
		SISDISX	Spectra	1.0000
		SISDISY	Spectra	0.3000
COMDIS6	ADD	DEAD	Static	0.9000
		SISDISX	Spectra	0.3000
		SISDISY	Spectra	1.0000
CIM2	ADD	DEAD	Static	1.0000
		LIVE	Static	0.7500
		SISDISX	Spectra	0.5250
		SISDISY	Spectra	0.1575
CIM3	ADD	DEAD	Static	1.0000
		LIVE	Static	0.7500
		SISDISX	Spectra	0.1575
		SISDISY	Spectra	0.5250
COMDER1	ADD	SISDERX	Spectra	1.0000
		SISDERY	Spectra	0.3000
COMDER2	ADD	SISDERX	Spectra	0.3000
		SISDERY	Spectra	1.0000
COMDERUMB1	ADD	SISUMBX	Spectra	1.0000
		SISUMBY	Spectra	0.3000
COMDERUMB2	ADD	SISUMBX	Spectra	0.3000
		SISUMBY	Spectra	1.0000
COMDIS7	ADD	LIVE	Static	1.6000
		DEAD	Static	1.2000
		VIENTO	Static	0.8000
COMDIS8	ADD	VIENTO	Static	1.6000
		DEAD	Static	1.2000
		LIVE	Static	1.0000
COMDIS9	ADD	VIENTO	Static	1.6000
		DEAD	Static	0.9000
COMDIS10	ADD	LIVE	Static	1.6000
		DEAD	Static	1.2000
		VIENTO	Static	-0.8000
COMDIS11	ADD	VIENTO	Static	-1.6000
		DEAD	Static	0.9000
ENVOLVENTE	ENVE	COMDIS1	Combo	1.0000
		COMDIS2	Combo	1.0000
		COMDIS3	Combo	1.0000
		COMDIS4	Combo	1.0000
		COMDIS5	Combo	1.0000
		COMDIS6	Combo	1.0000
		COMDIS7	Combo	1.0000
		COMDIS8	Combo	1.0000
		COMDIS9	Combo	1.0000
		COMDIS10	Combo	1.0000

COMDIS11 Combo 1.0000

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R E S P O N S E   S P E C T R U M   F U N C T I O N   -   F R O M   F I L E

FUNCTION NAME: DERIVAS

FILE NAME: c:\users\dyein_000\desktop\cristian\maria inmaculada\modelo\bloque a\derivas.txt
DATA TYPE: Period vs Acceleration
NUMBER OF HEADER LINES = 0

PERIOD	ACCEL
0.0000	1.1330
0.0500	1.1330
0.1000	1.1330
0.1600	1.1330
0.2100	1.1330
0.4000	1.1330
0.6000	1.1330
0.8000	1.1330
0.9900	1.1330
1.3400	0.8410
1.6800	0.6690
2.0300	0.5550
2.3700	0.4740
2.7200	0.4140
3.0600	0.3670
3.4100	0.3300
3.7500	0.3000
4.1000	0.2750
4.4400	0.2530
4.7900	0.2350
5.1300	0.2190
5.4800	0.2050
5.8200	0.1930
6.1700	0.1820
6.5100	0.1730
6.8600	0.1640
7.2000	0.1560
8.2000	0.1200
9.2000	0.0960

FUNCTION NAME: DISENO

FILE NAME: c:\users\dyein_000\desktop\cristian\maria inmaculada\modelo\bloque a\diseño.txt
DATA TYPE: Period vs Acceleration
NUMBER OF HEADER LINES = 0

PERIOD	ACCEL
0.0000	0.1618
0.0500	0.1618
0.1000	0.1618
0.1600	0.1618
0.2100	0.1618
0.4000	0.1618
0.6000	0.1618
0.8000	0.1618
0.9900	0.1618
1.3400	0.1201
1.6800	0.0955
2.0300	0.0793
2.3700	0.0677
2.7200	0.0591
3.0600	0.0525
3.4100	0.0472
3.7500	0.0428
4.1000	0.0392
4.4400	0.0362
4.7900	0.0336
5.1300	0.0313
5.4800	0.0293
5.8200	0.0276

6.1700	0.0261
6.5100	0.0247
6.8600	0.0234
7.2000	0.0223
8.2000	0.0172
9.2000	0.0137

FUNCTION NAME: UMBRAL

FILE NAME: c:\users\dyein_000\desktop\cristian\maria inmaculada\modelo\bloque a\umbral.txt
DATA TYPE: Period vs Acceleration
NUMBER OF HEADER LINES = 0

PERIOD	ACCEL
0.0000	0.0900
0.0500	0.1260
0.1000	0.1620
0.1500	0.1980
0.2000	0.2340
0.2500	0.2700
0.4900	0.2700
0.7300	0.2700
0.9800	0.2700
1.2200	0.2700
1.4600	0.2700
1.7000	0.2700
1.9500	0.2700
2.1900	0.2700
2.7800	0.2120
3.3800	0.1750
3.9700	0.1490
4.5600	0.1290
5.1600	0.1150
5.7500	0.1030
6.3400	0.0930
6.9400	0.0850
7.5300	0.0780
8.1300	0.0730
8.7200	0.0680
9.3100	0.0630
9.9100	0.0600
10.5000	0.0560
11.5000	0.0470
12.5000	0.0400

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F R A M E S E C T I O N A S S I G N M E N T S T O L I N E O B J E C T S

STORY LEVEL	LINE ID	LINE TYPE	SECTION TYPE	AUTO SELECT SECTION	ANALYSIS SECTION	DESIGN PROCEDURE	DESIGN SECTION
N+5.34	C20-1	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+5.34	C28	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+5.34	C21-1	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+5.34	C29	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+5.34	C22-1	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+5.34	C30	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+5.34	C31	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+3.95	C20	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+3.95	C21	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+3.95	C22	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+3.95	C3-2	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+3.95	C28	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+3.95	C6-1	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+3.95	C29	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+3.95	C9-1	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+3.95	C30	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+3.95	C12-1	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+3.95	C31	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+3.45	C1	Column	Rectangular	None	COL40X60	Conc Frame	COL40X60
N+3.45	C2	Column	Rectangular	None	COL40X60	Conc Frame	COL40X60
N+3.45	C3	Column	Rectangular	None	COL40X60	Conc Frame	COL40X60
N+3.45	C4	Column	Rectangular	None	COL40X60	Conc Frame	COL40X60
N+3.45	C5	Column	Rectangular	None	COL40X60	Conc Frame	COL40X60

N+3.45	C6	Column	Rectangular	None	COL40X60	Conc Frame	COL40X60
N+3.45	C7	Column	Rectangular	None	COL40X60	Conc Frame	COL40X60
N+3.45	C8	Column	Rectangular	None	COL40X60	Conc Frame	COL40X60
N+3.45	C9	Column	Rectangular	None	COL40X60	Conc Frame	COL40X60
N+3.45	C10	Column	Rectangular	None	COL40X60	Conc Frame	COL40X60
N+3.45	C11	Column	Rectangular	None	COL40X60	Conc Frame	COL40X60
N+3.45	C12	Column	Rectangular	None	COL40X60	Conc Frame	COL40X60
N+3.45	C20	Column	Rectangular	None	COL40X60	Conc Frame	COL40X60
N+3.45	C21	Column	Rectangular	None	COL40X60	Conc Frame	COL40X60
N+3.45	C22	Column	Rectangular	None	COL40X60	Conc Frame	COL40X60
N+3.45	C23	Column	Rectangular	None	COL40X60	Conc Frame	COL40X60
N+5.93	B12	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.93	B13	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	B83	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	B84	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	B85	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	B86	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	B87	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	B93	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	B94	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	B95	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.45	B1	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B2	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B3	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B6	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B7	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B8	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B9	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B12	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B13	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B14	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B17	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B18	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B19	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B20	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B23	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B24	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B25	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B61	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B62	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B63	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B64	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B65	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B66	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B67	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B72	Beam	Rectangular	None	VIG20X45	Conc Frame	VIG20X45
N+3.45	B73	Beam	Rectangular	None	VIG20X45	Conc Frame	VIG20X45
N+3.45	B74	Beam	Rectangular	None	VIG20X45	Conc Frame	VIG20X45
N+3.45	B75	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B76	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B77	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B78	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B79	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.45	B80	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.45	B81	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.45	B82	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.45	B88	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.45	B89	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.45	B90	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.45	B91	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.45	B92	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.45	B96	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.45	B97	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.45	B98	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.93	D92	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.93	D106	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.93	D113	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	D87	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	D88	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	D100	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	D102	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	D103	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	D107	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	D109	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	D110	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	D114	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	D116	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.95	D82	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4

N+3.95	D90	Brace	Box/Tube	None	180X65X4	Steel Frame 180X65X4
N+3.95	D91	Brace	Box/Tube	None	180X65X4	Steel Frame 180X65X4
N+3.95	D101	Brace	Box/Tube	None	180X65X4	Steel Frame 180X65X4
N+3.95	D104	Brace	Box/Tube	None	180X65X4	Steel Frame 180X65X4
N+3.95	D105	Brace	Box/Tube	None	180X65X4	Steel Frame 180X65X4
N+3.95	D108	Brace	Box/Tube	None	180X65X4	Steel Frame 180X65X4
N+3.95	D111	Brace	Box/Tube	None	180X65X4	Steel Frame 180X65X4
N+3.95	D112	Brace	Box/Tube	None	180X65X4	Steel Frame 180X65X4
N+3.95	D118	Brace	Box/Tube	None	180X65X4	Steel Frame 180X65X4
N+3.95	D119	Brace	Box/Tube	None	180X65X4	Steel Frame 180X65X4

D I S T R I B U T E D   L O A D   A S S I G N M E N T S   T O   L I N E   O B J E C T S

LOAD CASE	STORY LEVEL	LINE ID	LOAD TYPE	LOAD DIRECTION	ABSOLUTE DISTANCE A	ABSOLUTE DISTANCE B	LOAD A PER LENGTH	LOAD B PER LENGTH
VIENTO	N+5.34	C20-1	Force	Local-2	0.000	0.069	1.132	1.132
VIENTO	N+5.34	C21-1	Force	Local-2	0.000	0.069	2.108	2.108
VIENTO	N+5.34	C22-1	Force	Local-2	0.000	0.069	1.130	1.130
DEAD	N+5.93	D92	Force	Gravity	0.000	2.109	0.150	0.150
DEAD	N+5.93	D106	Force	Gravity	0.000	2.109	0.300	0.300
DEAD	N+5.93	D113	Force	Gravity	0.000	2.109	0.300	0.300
DEAD	N+5.34	D87	Force	Gravity	0.000	8.462	0.150	0.150
DEAD	N+5.34	D88	Force	Gravity	0.000	0.230	0.150	0.150
DEAD	N+5.34	D100	Force	Gravity	0.000	8.645	0.150	0.150
DEAD	N+5.34	D102	Force	Gravity	0.000	8.462	0.300	0.300
DEAD	N+5.34	D103	Force	Gravity	0.000	0.230	0.300	0.300
DEAD	N+5.34	D107	Force	Gravity	0.000	8.645	0.300	0.300
DEAD	N+5.34	D109	Force	Gravity	0.000	8.462	0.300	0.300
DEAD	N+5.34	D110	Force	Gravity	0.000	0.230	0.300	0.300
DEAD	N+5.34	D114	Force	Gravity	0.000	8.645	0.300	0.300
DEAD	N+5.34	D116	Force	Gravity	0.000	8.462	0.150	0.150
DEAD	N+3.95	D82	Force	Gravity	0.000	2.537	0.150	0.150
DEAD	N+3.95	D90	Force	Gravity	0.000	2.230	0.150	0.150
DEAD	N+3.95	D91	Force	Gravity	0.000	0.225	0.150	0.150
DEAD	N+3.95	D101	Force	Gravity	0.000	2.537	0.300	0.300
DEAD	N+3.95	D104	Force	Gravity	0.000	2.230	0.300	0.300
DEAD	N+3.95	D105	Force	Gravity	0.000	0.225	0.300	0.300
DEAD	N+3.95	D108	Force	Gravity	0.000	2.537	0.300	0.300
DEAD	N+3.95	D111	Force	Gravity	0.000	2.230	0.300	0.300
DEAD	N+3.95	D112	Force	Gravity	0.000	0.225	0.300	0.300
DEAD	N+3.95	D118	Force	Gravity	0.000	2.230	0.150	0.150
DEAD	N+3.95	D119	Force	Gravity	0.000	0.225	0.150	0.150
LIVE	N+5.93	D92	Force	Gravity	0.000	2.109	0.175	0.175
LIVE	N+5.93	D106	Force	Gravity	0.000	2.109	0.350	0.350
LIVE	N+5.93	D113	Force	Gravity	0.000	2.109	0.350	0.350
LIVE	N+5.34	D87	Force	Gravity	0.000	8.462	0.175	0.175
LIVE	N+5.34	D88	Force	Gravity	0.000	0.230	0.175	0.175
LIVE	N+5.34	D100	Force	Gravity	0.000	8.645	0.175	0.175
LIVE	N+5.34	D102	Force	Gravity	0.000	8.462	0.350	0.350
LIVE	N+5.34	D103	Force	Gravity	0.000	0.230	0.350	0.350
LIVE	N+5.34	D107	Force	Gravity	0.000	8.645	0.350	0.350
LIVE	N+5.34	D109	Force	Gravity	0.000	8.462	0.350	0.350
LIVE	N+5.34	D110	Force	Gravity	0.000	0.230	0.350	0.350
LIVE	N+5.34	D114	Force	Gravity	0.000	8.645	0.350	0.350
LIVE	N+5.34	D116	Force	Gravity	0.000	8.462	0.175	0.175
LIVE	N+3.95	D82	Force	Gravity	0.000	2.537	0.175	0.175
LIVE	N+3.95	D90	Force	Gravity	0.000	2.230	0.175	0.175
LIVE	N+3.95	D91	Force	Gravity	0.000	0.225	0.175	0.175
LIVE	N+3.95	D101	Force	Gravity	0.000	2.537	0.350	0.350
LIVE	N+3.95	D104	Force	Gravity	0.000	2.230	0.350	0.350
LIVE	N+3.95	D105	Force	Gravity	0.000	0.225	0.350	0.350
LIVE	N+3.95	D108	Force	Gravity	0.000	2.537	0.350	0.350
LIVE	N+3.95	D111	Force	Gravity	0.000	2.230	0.350	0.350
LIVE	N+3.95	D112	Force	Gravity	0.000	0.225	0.350	0.350
LIVE	N+3.95	D118	Force	Gravity	0.000	2.230	0.175	0.175
LIVE	N+3.95	D119	Force	Gravity	0.000	0.225	0.175	0.175
VIENTO	N+5.93	D92	Force	Local-2	0.000	2.109	1.132	1.132
VIENTO	N+5.93	D106	Force	Local-2	0.000	2.109	2.108	2.108
VIENTO	N+5.93	D113	Force	Local-2	0.000	2.109	1.130	1.130
VIENTO	N+5.34	D87	Force	Local-2	0.000	8.462	-1.132	-1.132
VIENTO	N+5.34	D88	Force	Local-2	0.000	0.230	1.132	1.132
VIENTO	N+5.34	D100	Force	Local-2	0.000	8.645	1.132	1.132
VIENTO	N+5.34	D102	Force	Local-2	0.000	8.462	-2.108	-2.108
VIENTO	N+5.34	D103	Force	Local-2	0.000	0.230	2.108	2.108
VIENTO	N+5.34	D107	Force	Local-2	0.000	8.645	2.108	2.108

VIENTO	N+5.34	D109	Force	Local-2	0.000	8.462	-2.108	-2.108
VIENTO	N+5.34	D110	Force	Local-2	0.000	0.230	1.130	1.130
VIENTO	N+5.34	D114	Force	Local-2	0.000	8.645	1.130	1.130
VIENTO	N+5.34	D116	Force	Local-2	0.000	8.462	-1.132	-1.132
VIENTO	N+3.95	D82	Force	Local-2	0.000	2.537	1.132	1.132
VIENTO	N+3.95	D90	Force	Local-2	0.000	2.230	-1.132	-1.132
VIENTO	N+3.95	D91	Force	Local-2	0.000	0.225	-1.132	-1.132
VIENTO	N+3.95	D101	Force	Local-2	0.000	2.537	2.108	2.108
VIENTO	N+3.95	D104	Force	Local-2	0.000	2.230	-2.108	-2.108
VIENTO	N+3.95	D105	Force	Local-2	0.000	0.225	-2.108	-2.108
VIENTO	N+3.95	D108	Force	Local-2	0.000	2.537	1.130	1.130
VIENTO	N+3.95	D111	Force	Local-2	0.000	2.230	-2.108	-2.108
VIENTO	N+3.95	D112	Force	Local-2	0.000	0.225	-2.108	-2.108
VIENTO	N+3.95	D118	Force	Local-2	0.000	2.230	-1.132	-1.132
VIENTO	N+3.95	D119	Force	Local-2	0.000	0.225	-1.132	-1.132

9.2 DATOS DE SALIDA

BEAM FORCES
UNID: kN-m

Story	Beam	Load	Loc	P	V2	T	M3
N+3.45	B1	ENVOLVENTE MAX	0	0	-4,81	0,348	7,848
N+3.45	B1	ENVOLVENTE MAX	2,635	0	5,8	0,348	9,307
N+3.45	B1	ENVOLVENTE MAX	5,27	0	19,46	0,348	0,103
N+3.45	B1	ENVOLVENTE MIN	0	0	-16,58	-0,487	-18,761
N+3.45	B1	ENVOLVENTE MIN	2,635	0	-3,28	-0,487	4,949
N+3.45	B1	ENVOLVENTE MIN	5,27	0	6,96	-0,487	-24,259
N+3.45	B2	ENVOLVENTE MAX	0	0	-4,69	-0,1	2,881
N+3.45	B2	ENVOLVENTE MAX	2,635	0	6,33	-0,1	2,712
N+3.45	B2	ENVOLVENTE MAX	5,27	0	19,99	-0,1	-9,359
N+3.45	B2	ENVOLVENTE MIN	0	0	-13,8	-1,107	-16,035
N+3.45	B2	ENVOLVENTE MIN	2,635	0	-0,91	-1,107	1,736
N+3.45	B2	ENVOLVENTE MIN	5,27	0	9,33	-1,107	-32,339
N+3.45	B3	ENVOLVENTE MAX	0	0	-32,52	0,391	-21,396
N+3.45	B3	ENVOLVENTE MAX	2,635	0	6,9	0,391	40,773
N+3.45	B3	ENVOLVENTE MAX	5,27	0	63,27	0,391	-29,221
N+3.45	B3	ENVOLVENTE MIN	0	0	-57,4	-0,366	-52,892
N+3.45	B3	ENVOLVENTE MIN	2,635	0	-2,49	-0,366	25,149
N+3.45	B3	ENVOLVENTE MIN	5,27	0	36,29	-0,366	-68,382
N+3.45	B6	ENVOLVENTE MAX	0	2,07	-10,86	1,103	-8,535
N+3.45	B6	ENVOLVENTE MAX	3,13	2,07	1,31	1,103	12,633
N+3.45	B6	ENVOLVENTE MAX	4,26	2,07	6,21	1,103	12,844
N+3.45	B6	ENVOLVENTE MAX	4,26	4,98	13,14	2,137	11,349
N+3.45	B6	ENVOLVENTE MAX	6,26	4,98	23,51	2,137	-10,035
N+3.45	B6	ENVOLVENTE MIN	0	-2,34	-19,85	-1,206	-22,68
N+3.45	B6	ENVOLVENTE MIN	3,13	-2,34	-3,12	-1,206	6,226
N+3.45	B6	ENVOLVENTE MIN	4,26	-2,34	1,89	-1,206	2,261
N+3.45	B6	ENVOLVENTE MIN	4,26	-4,41	1,98	-1,982	1,691
N+3.45	B6	ENVOLVENTE MIN	6,26	-4,41	9,75	-1,982	-26,249
N+3.45	B7	ENVOLVENTE MAX	0	3,33	-11,55	1,261	-9,858
N+3.45	B7	ENVOLVENTE MAX	3,13	3,33	0,62	1,261	15,475
N+3.45	B7	ENVOLVENTE MAX	4,26	3,33	5,01	1,261	17,512
N+3.45	B7	ENVOLVENTE MAX	4,26	8,21	18,76	2,213	17,181
N+3.45	B7	ENVOLVENTE MAX	6,26	8,21	29,12	2,213	-10,75
N+3.45	B7	ENVOLVENTE MIN	0	-3,85	-21,14	-1,017	-25,208
N+3.45	B7	ENVOLVENTE MIN	3,13	-3,85	-4,73	-1,017	6,781
N+3.45	B7	ENVOLVENTE MIN	4,26	-3,85	0,93	-1,017	3,603
N+3.45	B7	ENVOLVENTE MIN	4,26	-7,09	1,19	-2,112	-0,592
N+3.45	B7	ENVOLVENTE MIN	6,26	-7,09	8,97	-2,112	-30,599
N+3.45	B8	ENVOLVENTE MAX	0	0,44	-29,98	0,451	-31,719
N+3.45	B8	ENVOLVENTE MAX	3,13	0,44	2,44	0,451	39,221
N+3.45	B8	ENVOLVENTE MAX	4,26	0,44	23,74	0,451	32,359
N+3.45	B8	ENVOLVENTE MAX	4,26	1,03	28,96	1,568	27,156
N+3.45	B8	ENVOLVENTE MAX	6,26	1,03	53,9	1,568	-32,13
N+3.45	B8	ENVOLVENTE MIN	0	-0,48	-51,76	-2,03	-59,646
N+3.45	B8	ENVOLVENTE MIN	3,13	-0,48	-5,31	-2,03	21,059
N+3.45	B8	ENVOLVENTE MIN	4,26	-0,48	11,93	-2,03	8,878
N+3.45	B8	ENVOLVENTE MIN	4,26	-0,94	16,06	-2,982	13,819
N+3.45	B8	ENVOLVENTE MIN	6,26	-0,94	32,3	-2,982	-60,894
N+3.45	B9	ENVOLVENTE MAX	0	0,2	-29,34	2,566	-28,313
N+3.45	B9	ENVOLVENTE MAX	3,13	0,2	3,05	2,566	38,664
N+3.45	B9	ENVOLVENTE MAX	4,26	0,2	24,2	2,566	30,643
N+3.45	B9	ENVOLVENTE MAX	4,26	0,58	27,24	3,278	25,046
N+3.45	B9	ENVOLVENTE MAX	6,26	0,58	52,51	3,278	-29,001
N+3.45	B9	ENVOLVENTE MIN	0	-0,27	-51,3	-0,07	-60,265
N+3.45	B9	ENVOLVENTE MIN	3,13	-0,27	-4,7	-0,07	20,484
N+3.45	B9	ENVOLVENTE MIN	4,26	-0,27	11,91	-0,07	7,611
N+3.45	B9	ENVOLVENTE MIN	4,26	-0,42	14,41	-1,024	12,36
N+3.45	B9	ENVOLVENTE MIN	6,26	-0,42	30,65	-1,024	-60,517
N+3.45	B12	ENVOLVENTE MAX	0	0	-4,97	0,655	7,166
N+3.45	B12	ENVOLVENTE MAX	2,635	0	5,68	0,655	9,038
N+3.45	B12	ENVOLVENTE MAX	5,27	0	19,34	0,655	-1,286
N+3.45	B12	ENVOLVENTE MIN	0	0	-16,04	-0,353	-17,486
N+3.45	B12	ENVOLVENTE MIN	2,635	0	-2,79	-0,353	4,853
N+3.45	B12	ENVOLVENTE MIN	5,27	0	7,48	-0,353	-24,267
N+3.45	B13	ENVOLVENTE MAX	0	0	-6,05	1,479	0,708
N+3.45	B13	ENVOLVENTE MAX	2,635	0	4,59	1,479	4,923
N+3.45	B13	ENVOLVENTE MAX	5,27	0	18,25	1,479	-5,615
N+3.45	B13	ENVOLVENTE MIN	0	0	-15,05	0,294	-17,442
N+3.45	B13	ENVOLVENTE MIN	2,635	0	-1,79	0,294	3,181
N+3.45	B13	ENVOLVENTE MIN	5,27	0	8,45	0,294	-25,867
N+3.45	B14	ENVOLVENTE MAX	0	0	-18,21	0,349	-8,318
N+3.45	B14	ENVOLVENTE MAX	2,635	0	7,63	0,349	22,14
N+3.45	B14	ENVOLVENTE MAX	5,27	0	42,99	0,349	-20,583
N+3.45	B14	ENVOLVENTE MIN	0	0	-34,61	-0,571	-33,648
N+3.45	B14	ENVOLVENTE MIN	2,635	0	-1,34	-0,571	13,271
N+3.45	B14	ENVOLVENTE MIN	5,27	0	23,6	-0,571	-54,509
N+3.45	B17	ENVOLVENTE MAX	0	0	-10,93	0,459	-8,944
N+3.45	B17	ENVOLVENTE MAX	3,13	0	1,24	0,459	10,621
N+3.45	B17	ENVOLVENTE MAX	6,26	0	17,89	0,459	-3,234
N+3.45	B17	ENVOLVENTE MIN	0	0	-19,97	-0,447	-24,741
N+3.45	B17	ENVOLVENTE MIN	3,13	0	-2,88	-0,447	5,951
N+3.45	B17	ENVOLVENTE MIN	6,26	0	9,59	-0,447	-19,348
N+3.45	B18	ENVOLVENTE MAX	0	0	-10,95	0,376	-9,471

[illegible]	B18	ENVOLVENTE MAX	3,13	0	1,22	0,376	10,357
N+3.45	B18	ENVOLVENTE MAX	6,26	0	17,69	0,376	-2,213
N+3.45	B18	ENVOLVENTE MIN	0	0	-20,17	-0,196	-25,773
N+3.45	B18	ENVOLVENTE MIN	3,13	0	-3,21	-0,196	5,317
N+3.45	B18	ENVOLVENTE MIN	6,26	0	9,35	-0,196	-19,117
N+3.45	B19	ENVOLVENTE MAX	0	0	-11,03	-0,332	-10,518
N+3.45	B19	ENVOLVENTE MAX	3,13	0	1,14	-0,332	9,554
N+3.45	B19	ENVOLVENTE MAX	6,26	0	16,71	-0,332	0,471
N+3.45	B19	ENVOLVENTE MIN	0	0	-21,4	-1,106	-33,175
N+3.45	B19	ENVOLVENTE MIN	3,13	0	-4,96	-1,106	4,599
N+3.45	B19	ENVOLVENTE MIN	6,26	0	7,86	-1,106	-20,228
N+3.45	B20	ENVOLVENTE MAX	0	0	-10,2	0,609	-7,611
N+3.45	B20	ENVOLVENTE MAX	3,13	0	1,97	0,609	9,174
N+3.45	B20	ENVOLVENTE MAX	6,26	0	17,54	0,609	4,682
N+3.45	B20	ENVOLVENTE MIN	0	0	-22,37	-0,199	-36,161
N+3.45	B20	ENVOLVENTE MIN	3,13	0	-6,15	-0,199	5,278
N+3.45	B20	ENVOLVENTE MIN	6,26	0	6,67	-0,199	-22,281
N+3.45	B23	ENVOLVENTE MAX	0	0	-4,69	0,683	7,776
N+3.45	B23	ENVOLVENTE MAX	2,635	0	6,02	0,683	8,823
N+3.45	B23	ENVOLVENTE MAX	5,27	0	19,88	0,683	-1,601
N+3.45	B23	ENVOLVENTE MIN	0	0	-15,92	-0,714	-17,356
N+3.45	B23	ENVOLVENTE MIN	2,635	0	-2,73	-0,714	4,706
N+3.45	B23	ENVOLVENTE MIN	5,27	0	7,52	-0,714	-25,338
N+3.45	B24	ENVOLVENTE MAX	0	0	-6,99	0,579	-0,413
N+3.45	B24	ENVOLVENTE MAX	2,635	0	3,31	0,579	6,997
N+3.45	B24	ENVOLVENTE MAX	5,27	0	16,97	0,579	-1,292
N+3.45	B24	ENVOLVENTE MIN	0	0	-16,53	-0,79	-19,557
N+3.45	B24	ENVOLVENTE MIN	2,635	0	-2,92	-0,79	4,478
N+3.45	B24	ENVOLVENTE MIN	5,27	0	7,32	-0,79	-20,731
N+3.45	B25	ENVOLVENTE MAX	0	0	-4,33	0,833	4,171
N+3.45	B25	ENVOLVENTE MAX	2,635	0	6,51	0,833	4,993
N+3.45	B25	ENVOLVENTE MAX	5,27	0	20,17	0,833	-3,342
N+3.45	B25	ENVOLVENTE MIN	0	0	-15,41	-0,292	-17,618
N+3.45	B25	ENVOLVENTE MIN	2,635	0	-2,34	-0,292	2,07
N+3.45	B25	ENVOLVENTE MIN	5,27	0	7,9	-0,292	-32,073
N+3.45	B61	ENVOLVENTE MAX	0	3,05	-4,15	0,879	9,544
N+3.45	B61	ENVOLVENTE MAX	2,635	3,05	6,48	0,879	9,142
N+3.45	B61	ENVOLVENTE MAX	5,27	3,05	20,14	0,879	1,198
N+3.45	B61	ENVOLVENTE MIN	0	-6,59	-17,04	-0,569	-20,161
N+3.45	B61	ENVOLVENTE MIN	2,635	-6,59	-3,77	-0,569	4,771
N+3.45	B61	ENVOLVENTE MIN	5,27	-6,59	6,48	-0,569	-26,143
N+3.45	B62	ENVOLVENTE MAX	0	10,19	-5,13	0,459	2,884
N+3.45	B62	ENVOLVENTE MAX	2,635	10,19	5,58	0,459	4,495
N+3.45	B62	ENVOLVENTE MAX	5,27	10,19	19,24	0,459	-4,432
N+3.45	B62	ENVOLVENTE MIN	0	-8,96	-15,53	-0,756	-19,073
N+3.45	B62	ENVOLVENTE MIN	2,635	-8,96	-2,34	-0,756	2,846
N+3.45	B62	ENVOLVENTE MIN	5,27	-8,96	7,91	-0,756	-28,855
N+3.45	B63	ENVOLVENTE MAX	0	1,63	-18,38	0,25	-7,853
N+3.45	B63	ENVOLVENTE MAX	2,635	1,63	5,99	0,25	23,969
N+3.45	B63	ENVOLVENTE MAX	5,27	1,63	38,78	0,25	-10,305
N+3.45	B63	ENVOLVENTE MIN	0	-4,04	-38,16	-0,674	-37,899
N+3.45	B63	ENVOLVENTE MIN	2,635	-4,04	-4,02	-0,674	14,353
N+3.45	B63	ENVOLVENTE MIN	5,27	-4,04	20,07	-0,674	-45,959
N+3.45	B64	ENVOLVENTE MAX	0	4,78	-3,16	0,44	4,596
N+3.45	B64	ENVOLVENTE MAX	2	4,78	4,87	0,44	3,427
N+3.45	B64	ENVOLVENTE MAX	4	4,78	15,24	0,44	-0,193
N+3.45	B64	ENVOLVENTE MIN	0	-1,8	-13,05	-0,422	-13,826
N+3.45	B64	ENVOLVENTE MIN	2	-1,8	-2,95	-0,422	1,258
N+3.45	B64	ENVOLVENTE MIN	4	-1,8	4,83	-0,422	-16,759
N+3.45	B65	ENVOLVENTE MAX	0	6,9	-2,97	0,199	5,13
N+3.45	B65	ENVOLVENTE MAX	2	6,9	5,01	0,199	3,285
N+3.45	B65	ENVOLVENTE MAX	4	6,9	15,37	0,199	-0,49
N+3.45	B65	ENVOLVENTE MIN	0	-2,98	-13,11	-0,381	-14,623
N+3.45	B65	ENVOLVENTE MIN	2	-2,98	-3,06	-0,381	0,728
N+3.45	B65	ENVOLVENTE MIN	4	-2,98	4,71	-0,381	-17,261
N+3.45	B66	ENVOLVENTE MAX	0	4,46	-8,04	1,432	3,494
N+3.45	B66	ENVOLVENTE MAX	2	4,46	9,09	1,432	8,407
N+3.45	B66	ENVOLVENTE MAX	4	4,46	30,75	1,432	-8,191
N+3.45	B66	ENVOLVENTE MIN	0	-1,02	-23,88	0,566	-23,546
N+3.45	B66	ENVOLVENTE MIN	2	-1,02	-3,1	0,566	4,082
N+3.45	B66	ENVOLVENTE MIN	4	-1,02	13,14	0,566	-35,812
N+3.45	B67	ENVOLVENTE MAX	0	1,1	-5,62	0,224	8,726
N+3.45	B67	ENVOLVENTE MAX	2	1,1	11,61	0,224	8,969
N+3.45	B67	ENVOLVENTE MAX	4	1,1	33,26	0,224	-4,724
N+3.45	B67	ENVOLVENTE MIN	0	-4,51	-23,35	-0,355	-25,943
N+3.45	B67	ENVOLVENTE MIN	2	-4,51	-4,68	-0,355	4,983
N+3.45	B67	ENVOLVENTE MIN	4	-4,51	11,56	-0,355	-40,199
N+3.45	B72	ENVOLVENTE MAX	0	0,64	-5,68	0,493	-4,165
N+3.45	B72	ENVOLVENTE MAX	3,13	0,64	0,41	0,493	6,359
N+3.45	B72	ENVOLVENTE MAX	6,26	0,64	9,47	0,493	-4,176
N+3.45	B72	ENVOLVENTE MIN	0	-0,67	-9,46	0,166	-8,491
N+3.45	B72	ENVOLVENTE MIN	3,13	-0,67	-0,4	0,166	4,015
N+3.45	B72	ENVOLVENTE MIN	6,26	-0,67	5,68	0,166	-8,512
N+3.45	B73	ENVOLVENTE MAX	0	0,21	-6,16	-0,231	-5,831
N+3.45	B73	ENVOLVENTE MAX	3,13	0,21	-0,07	-0,231	6,759
N+3.45	B73	ENVOLVENTE MAX	6,26	0,21	8,4	-0,231	-0,7
N+3.45	B73	ENVOLVENTE MIN	0	-0,22	-10,53	-0,425	-11,38
N+3.45	B73	ENVOLVENTE MIN	3,13	-0,22	-1,53	-0,425	3,918
N+3.45	B73	ENVOLVENTE MIN	6,26	-0,22	4,79	-0,425	-6,363
N+3.45	B74	ENVOLVENTE MAX	0	0,81	-2,31	0,76	0,723

[illegible]	B74	ENVOLVENTE MAX	2	0,81	1,62	0,76	1,773
N+3.45	B74	ENVOLVENTE MAX	4	0,81	7,22	0,76	-3,298
N+3.45	B74	ENVOLVENTE MIN	0	-0,86	-5	0,443	-4,053
N+3.45	B74	ENVOLVENTE MIN	2	-0,86	-0,07	0,443	0,456
N+3.45	B74	ENVOLVENTE MIN	4	-0,86	3,62	0,443	-7,06
N+3.45	B75	ENVOLVENTE MAX	0	1,82	-13,34	6,363	-20,192
N+3.45	B75	ENVOLVENTE MAX	1,1	1,82	-9,07	6,363	-7,865
N+3.45	B75	ENVOLVENTE MAX	2,2	1,82	-4,79	6,363	-0,231
N+3.45	B75	ENVOLVENTE MIN	0	-1,82	-21,71	0,7	-33,547
N+3.45	B75	ENVOLVENTE MIN	1,1	-1,82	-15,06	0,7	-13,327
N+3.45	B75	ENVOLVENTE MIN	2,2	-1,82	-8,4	0,7	-0,425
N+3.45	B76	ENVOLVENTE MAX	0	2,72	-21,2	0,881	-36,758
N+3.45	B76	ENVOLVENTE MAX	1,1	2,72	-16,92	0,881	-15,788
N+3.45	B76	ENVOLVENTE MAX	2,2	2,72	-12,65	0,881	0,865
N+3.45	B76	ENVOLVENTE MIN	0	-2,72	-33,3	-5,29	-57,767
N+3.45	B76	ENVOLVENTE MIN	1,1	-2,72	-26,65	-5,29	-24,792
N+3.45	B76	ENVOLVENTE MIN	2,2	-2,72	-20	-5,29	0,473
N+3.45	B77	ENVOLVENTE MAX	0	2,46	-18,86	1,409	-32,021
N+3.45	B77	ENVOLVENTE MAX	1,1	2,46	-14,58	1,409	-13,627
N+3.45	B77	ENVOLVENTE MAX	2,2	2,46	-10,31	1,409	0,42
N+3.45	B77	ENVOLVENTE MIN	0	-2,45	-29,99	-3,707	-51,012
N+3.45	B77	ENVOLVENTE MIN	1,1	-2,45	-23,33	-3,707	-21,686
N+3.45	B77	ENVOLVENTE MIN	2,2	-2,45	-16,68	-3,707	0,082
N+3.45	B78	ENVOLVENTE MAX	0	1,84	-10,87	0,723	-15,021
N+3.45	B78	ENVOLVENTE MAX	1,1	1,84	-6,59	0,723	-5,418
N+3.45	B78	ENVOLVENTE MAX	2,2	1,84	-2,31	0,723	-0,443
N+3.45	B78	ENVOLVENTE MIN	0	-1,84	-18,18	-4,053	-26,123
N+3.45	B78	ENVOLVENTE MIN	1,1	-1,84	-11,53	-4,053	-9,783
N+3.45	B78	ENVOLVENTE MIN	2,2	-1,84	-5	-4,053	-0,78
N+3.45	B79	ENVOLVENTE MAX	0	3,1	1,49	0,065	2,422
N+3.45	B79	ENVOLVENTE MAX	1,06	3,1	1,64	0,065	0,774
N+3.45	B79	ENVOLVENTE MAX	2,12	3,1	1,82	0,065	0,978
N+3.45	B79	ENVOLVENTE MIN	0	-6,27	-1,93	-0,015	-2,809
N+3.45	B79	ENVOLVENTE MIN	1,06	-6,27	-1,79	-0,015	-0,842
N+3.45	B79	ENVOLVENTE MIN	2,12	-6,27	-1,65	-0,015	-1,061
N+3.45	B80	ENVOLVENTE MAX	0	6,03	2,65	0,018	4,164
N+3.45	B80	ENVOLVENTE MAX	1,06	6,03	2,83	0,018	1,264
N+3.45	B80	ENVOLVENTE MAX	2,12	6,03	3,01	0,018	1,676
N+3.45	B80	ENVOLVENTE MIN	0	-12	-3,12	-0,03	-4,635
N+3.45	B80	ENVOLVENTE MIN	1,06	-12	-2,98	-0,03	-1,406
N+3.45	B80	ENVOLVENTE MIN	2,12	-12	-2,84	-0,03	-1,835
N+3.45	B81	ENVOLVENTE MAX	0	5,63	2,11	0,038	3,305
N+3.45	B81	ENVOLVENTE MAX	1,06	5,63	2,25	0,038	0,997
N+3.45	B81	ENVOLVENTE MAX	2,12	5,63	2,41	0,038	1,565
N+3.45	B81	ENVOLVENTE MIN	0	-11,42	-2,92	-0,026	-4,33
N+3.45	B81	ENVOLVENTE MIN	1,06	-11,42	-2,78	-0,026	-1,309
N+3.45	B81	ENVOLVENTE MIN	2,12	-11,42	-2,64	-0,026	-1,491
N+3.45	B82	ENVOLVENTE MAX	0	2,47	1,18	-0,031	0,715
N+3.45	B82	ENVOLVENTE MAX	1,06	2,47	1,32	-0,031	0,727
N+3.45	B82	ENVOLVENTE MAX	2,12	2,47	1,46	-0,031	2,276
N+3.45	B82	ENVOLVENTE MIN	0	-6,45	-1,74	-0,109	-1,018
N+3.45	B82	ENVOLVENTE MIN	1,06	-6,45	-1,55	-0,109	-0,613
N+3.45	B82	ENVOLVENTE MIN	2,12	-6,45	-1,37	-0,109	-2,088
N+3.45	B88	ENVOLVENTE MAX	0	0,22	-0,22	0,041	0,125
N+3.45	B88	ENVOLVENTE MAX	2,635	0,22	0,15	0,041	0,365
N+3.45	B88	ENVOLVENTE MAX	5,27	0,22	0,64	0,041	-0,193
N+3.45	B88	ENVOLVENTE MIN	0	-0,21	-0,43	-0,047	-0,22
N+3.45	B88	ENVOLVENTE MIN	2,635	-0,21	0,01	-0,047	0,185
N+3.45	B88	ENVOLVENTE MIN	5,27	-0,21	0,35	-0,047	-0,742
N+3.45	B89	ENVOLVENTE MAX	0	0,04	-0,33	0,009	-0,226
N+3.45	B89	ENVOLVENTE MAX	2,635	0,04	0,02	0,009	0,223
N+3.45	B89	ENVOLVENTE MAX	5,27	0,04	0,5	0,009	-0,136
N+3.45	B89	ENVOLVENTE MIN	0	-0,03	-0,58	-0,026	-0,884
N+3.45	B89	ENVOLVENTE MIN	2,635	-0,03	-0,08	-0,026	0,041
N+3.45	B89	ENVOLVENTE MIN	5,27	-0,03	0,28	-0,026	-0,464
N+3.45	B90	ENVOLVENTE MAX	0	0,22	-0,32	0,061	-0,14
N+3.45	B90	ENVOLVENTE MAX	2,635	0,22	0,03	0,061	0,401
N+3.45	B90	ENVOLVENTE MAX	5,27	0,22	0,49	0,061	0,034
N+3.45	B90	ENVOLVENTE MIN	0	-0,2	-0,58	-0,026	-0,488
N+3.45	B90	ENVOLVENTE MIN	2,635	-0,2	-0,09	-0,026	0,225
N+3.45	B90	ENVOLVENTE MIN	5,27	-0,2	0,26	-0,026	-0,322
N+3.45	B91	ENVOLVENTE MAX	0	0,08	-0,22	0,046	0,112
N+3.45	B91	ENVOLVENTE MAX	2,635	0,08	0,15	0,046	0,359
N+3.45	B91	ENVOLVENTE MAX	5,27	0,08	0,65	0,046	-0,22
N+3.45	B91	ENVOLVENTE MIN	0	-0,08	-0,42	-0,032	-0,201
N+3.45	B91	ENVOLVENTE MIN	2,635	-0,08	0,02	-0,032	0,164
N+3.45	B91	ENVOLVENTE MIN	5,27	-0,08	0,36	-0,032	-0,736
N+3.45	B92	ENVOLVENTE MAX	0	0,08	-0,37	0,024	-0,237
N+3.45	B92	ENVOLVENTE MAX	2,635	0,08	-0,02	0,024	0,343
N+3.45	B92	ENVOLVENTE MAX	5,27	0,08	0,43	0,024	0,071
N+3.45	B92	ENVOLVENTE MIN	0	-0,08	-0,65	-0,015	-0,728
N+3.45	B92	ENVOLVENTE MIN	2,635	-0,08	-0,14	-0,015	0,143
N+3.45	B92	ENVOLVENTE MIN	5,27	-0,08	0,22	-0,015	-0,213
N+3.45	B96	ENVOLVENTE MAX	0	3,76	0,88	0,012	0,627
N+3.45	B96	ENVOLVENTE MAX	1,32	3,76	1,11	0,012	0,568
N+3.45	B96	ENVOLVENTE MAX	2,64	3,76	1,34	0,012	1,392
N+3.45	B96	ENVOLVENTE MIN	0	-7	-0,88	-0,062	-0,485
N+3.45	B96	ENVOLVENTE MIN	1,32	-7	-0,71	-0,062	-0,69
N+3.45	B96	ENVOLVENTE MIN	2,64	-7	-0,54	-0,062	-2,312
N+3.45	B97	ENVOLVENTE MAX	0	7,39	1,47	0,014	0,95

N+3.45	B97	ENVOLVENTE MAX	2,64	7,39	1,93	0,014	2,247
N+3.45	B97	ENVOLVENTE MIN	0	-14,37	-1,29	-0,026	-0,708
N+3.45	B97	ENVOLVENTE MIN	1,32	-14,37	-1,12	-0,026	-1,138
N+3.45	B97	ENVOLVENTE MIN	2,64	-14,37	-0,95	-0,026	-3,531
N+3.45	B98	ENVOLVENTE MAX	0	4,09	1,46	0,064	1,051
N+3.45	B98	ENVOLVENTE MAX	1,32	4,09	1,69	0,064	0,64
N+3.45	B98	ENVOLVENTE MAX	2,64	4,09	1,92	0,064	1,638
N+3.45	B98	ENVOLVENTE MIN	0	-7,43	-1,02	0,012	-0,586
N+3.45	B98	ENVOLVENTE MIN	1,32	-7,43	-0,84	0,012	-1,024
N+3.45	B98	ENVOLVENTE MIN	2,64	-7,43	-0,67	0,012	-3,403

FUERZAS EN COLUMNAS

COLUMN FORCES
UNID: kN-m

Story	Column	Load	Loc	P	V2	V3	T	M2	M3
N+3.45	C1	ENVOLVENTE MAX	0,000	-43,110	7,900	5,790	0,935	14,429	19,829
N+3.45	C1	ENVOLVENTE MAX	1,750	-34,040	7,900	5,790	0,935	4,856	6,566
N+3.45	C1	ENVOLVENTE MAX	3,500	-24,960	7,900	5,790	0,935	20,261	18,817
N+3.45	C1	ENVOLVENTE MIN	0,000	-75,730	-11,500	-12,320	-0,984	-22,156	-21,423
N+3.45	C1	ENVOLVENTE MIN	1,750	-61,620	-11,500	-12,320	-0,984	-1,514	-1,967
N+3.45	C1	ENVOLVENTE MIN	3,500	-47,510	-11,500	-12,320	-0,984	-5,849	-8,024
N+3.45	C2	ENVOLVENTE MAX	0,000	-50,480	7,390	8,540	0,935	17,308	18,516
N+3.45	C2	ENVOLVENTE MAX	1,750	-41,410	7,390	8,540	0,935	2,852	6,250
N+3.45	C2	ENVOLVENTE MAX	3,500	-32,340	7,390	8,540	0,935	9,340	17,526
N+3.45	C2	ENVOLVENTE MIN	0,000	-84,910	-10,580	-7,100	-0,984	-16,367	-19,530
N+3.45	C2	ENVOLVENTE MIN	1,750	-70,790	-10,580	-7,100	-0,984	-4,419	-1,684
N+3.45	C2	ENVOLVENTE MIN	3,500	-56,680	-10,580	-7,100	-0,984	-12,577	-7,380
N+3.45	C3	ENVOLVENTE MAX	0,000	-32,020	7,510	10,240	0,935	19,198	18,833
N+3.45	C3	ENVOLVENTE MAX	1,750	-22,950	7,510	10,240	0,935	3,591	6,356
N+3.45	C3	ENVOLVENTE MAX	3,500	-13,880	7,510	10,240	0,935	-4,229	17,228
N+3.45	C3	ENVOLVENTE MIN	0,000	-66,880	-10,460	-1,720	-0,984	-10,330	-19,395
N+3.45	C3	ENVOLVENTE MIN	1,750	-54,780	-10,460	-1,720	-0,984	-9,647	-1,753
N+3.45	C3	ENVOLVENTE MIN	3,500	-42,690	-10,460	-1,720	-0,984	-16,751	-7,460
N+3.45	C4	ENVOLVENTE MAX	0,000	-57,200	15,340	4,960	0,935	13,171	28,633
N+3.45	C4	ENVOLVENTE MAX	1,750	-48,130	15,340	4,960	0,935	5,280	1,915
N+3.45	C4	ENVOLVENTE MAX	3,500	-39,060	15,340	4,960	0,935	22,578	14,487
N+3.45	C4	ENVOLVENTE MIN	0,000	-92,760	-9,810	-13,100	-0,984	-23,261	-19,843
N+3.45	C4	ENVOLVENTE MIN	1,750	-78,650	-9,810	-13,100	-0,984	-1,133	-2,808
N+3.45	C4	ENVOLVENTE MIN	3,500	-64,540	-9,810	-13,100	-0,984	-4,196	-25,063
N+3.45	C5	ENVOLVENTE MAX	0,000	-62,650	14,020	9,720	0,935	18,258	26,477
N+3.45	C5	ENVOLVENTE MAX	1,750	-53,570	14,020	9,720	0,935	2,170	1,998
N+3.45	C5	ENVOLVENTE MAX	3,500	-44,500	14,020	9,720	0,935	8,215	13,847
N+3.45	C5	ENVOLVENTE MIN	0,000	-106,090	-9,190	-6,280	-0,984	-15,176	-18,311
N+3.45	C5	ENVOLVENTE MIN	1,750	-91,980	-9,190	-6,280	-0,984	-5,483	-2,206
N+3.45	C5	ENVOLVENTE MIN	3,500	-77,870	-9,190	-6,280	-0,984	-15,763	-22,589
N+3.45	C6	ENVOLVENTE MAX	0,000	-37,330	13,710	9,360	0,935	17,737	26,326
N+3.45	C6	ENVOLVENTE MAX	1,750	-28,260	13,710	9,360	0,935	4,757	2,342
N+3.45	C6	ENVOLVENTE MAX	3,500	-19,180	13,710	9,360	0,935	1,373	14,522
N+3.45	C6	ENVOLVENTE MIN	0,000	-96,600	-9,490	-1,650	-0,984	-10,131	-18,677
N+3.45	C6	ENVOLVENTE MIN	1,750	-84,510	-9,490	-1,650	-0,984	-10,632	-2,081
N+3.45	C6	ENVOLVENTE MIN	3,500	-72,410	-9,490	-1,650	-0,984	-20,729	-21,650
N+3.45	C7	ENVOLVENTE MAX	0,000	-116,400	7,340	4,130	0,935	16,275	19,120
N+3.45	C7	ENVOLVENTE MAX	1,750	-107,330	7,340	4,130	0,935	10,821	7,610
N+3.45	C7	ENVOLVENTE MAX	3,500	-98,260	7,340	4,130	0,935	43,785	35,676
N+3.45	C7	ENVOLVENTE MIN	0,000	-186,170	-18,660	-23,830	-0,984	-39,623	-29,620
N+3.45	C7	ENVOLVENTE MIN	1,750	-172,060	-18,660	-23,830	-0,984	0,300	1,696
N+3.45	C7	ENVOLVENTE MIN	3,500	-157,950	-18,660	-23,830	-0,984	1,806	-6,564
N+3.45	C8	ENVOLVENTE MAX	0,000	-99,140	9,840	22,650	0,935	36,680	21,315
N+3.45	C8	ENVOLVENTE MAX	1,750	-90,070	9,840	22,650	0,935	-0,566	4,776
N+3.45	C8	ENVOLVENTE MAX	3,500	-81,000	9,840	22,650	0,935	-4,748	23,578
N+3.45	C8	ENVOLVENTE MIN	0,000	-155,930	-13,160	-3,350	-0,984	-16,458	-22,483
N+3.45	C8	ENVOLVENTE MIN	1,750	-141,820	-13,160	-3,350	-0,984	-12,987	-0,129
N+3.45	C8	ENVOLVENTE MIN	3,500	-127,710	-13,160	-3,350	-0,984	-42,579	-13,115
N+3.45	C9	ENVOLVENTE MAX	0,000	-32,940	13,710	10,870	0,935	23,473	26,324
N+3.45	C9	ENVOLVENTE MAX	1,750	-23,870	13,710	10,870	0,935	5,272	2,343
N+3.45	C9	ENVOLVENTE MAX	3,500	-14,790	13,710	10,870	0,935	1,606	14,518
N+3.45	C9	ENVOLVENTE MIN	0,000	-94,430	-9,480	-5,640	-0,984	-18,965	-18,675
N+3.45	C9	ENVOLVENTE MIN	1,750	-82,330	-9,480	-5,640	-0,984	-9,926	-2,082
N+3.45	C9	ENVOLVENTE MIN	3,500	-70,230	-9,480	-5,640	-0,984	-15,421	-21,646
N+3.45	C10	ENVOLVENTE MAX	0,000	-123,280	14,490	10,320	0,935	28,934	27,657
N+3.45	C10	ENVOLVENTE MAX	1,750	-114,200	14,490	10,320	0,935	12,486	2,724
N+3.45	C10	ENVOLVENTE MAX	3,500	-105,130	14,490	10,320	0,935	53,160	4,609
N+3.45	C10	ENVOLVENTE MIN	0,000	-202,670	-5,610	-30,320	-0,984	-52,965	-15,037
N+3.45	C10	ENVOLVENTE MIN	1,750	-188,560	-5,610	-30,320	-0,984	-1,512	-5,642
N+3.45	C10	ENVOLVENTE MIN	3,500	-174,440	-5,610	-30,320	-0,984	-7,161	-23,065
N+3.45	C11	ENVOLVENTE MAX	0,000	-110,010	7,460	26,980	0,935	47,232	18,594
N+3.45	C11	ENVOLVENTE MAX	1,750	-100,940	7,460	26,980	0,935	1,893	6,193
N+3.45	C11	ENVOLVENTE MAX	3,500	-91,860	7,460	26,980	0,935	5,654	17,263
N+3.45	C11	ENVOLVENTE MIN	0,000	-178,700	-10,470	-10,250	-0,984	-30,215	-19,404
N+3.45	C11	ENVOLVENTE MIN	1,750	-164,590	-10,470	-10,250	-0,984	-14,164	-1,734
N+3.45	C11	ENVOLVENTE MIN	3,500	-150,480	-10,470	-10,250	-0,984	-47,212	-7,536
N+3.45	C12	ENVOLVENTE MAX	0,000	-47,150	6,750	18,750	0,935	38,037	17,989
N+3.45	C12	ENVOLVENTE MAX	1,750	-38,080	6,750	18,750	0,935	6,428	6,967
N+3.45	C12	ENVOLVENTE MAX	3,500	-29,000	6,750	18,750	0,935	2,976	19,736
N+3.45	C12	ENVOLVENTE MIN	0,000	-89,250	-11,530	-9,120	-0,984	-28,957	-20,614

[illegible]	[illegible]	ENVOLVENTE MIN	1,750	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
N+3.45	C12	ENVOLVENTE MIN	3,500	-63,780	-11,530	-9,120	-0,964	-27,609	-5,664
N+3.45	C20	ENVOLVENTE MAX	0,000	-27,790	8,890	5,260	0,769	13,759	21,910
N+3.45	C20	ENVOLVENTE MAX	1,750	-18,720	8,890	5,260	0,769	5,096	7,004
N+3.45	C20	ENVOLVENTE MAX	3,500	-9,650	8,890	5,260	0,769	9,163	20,030
N+3.45	C20	ENVOLVENTE MIN	0,000	-58,360	-12,460	-7,450	-0,782	-16,943	-23,591
N+3.45	C20	ENVOLVENTE MIN	1,750	-45,150	-12,460	-7,450	-0,782	-4,449	-2,441
N+3.45	C20	ENVOLVENTE MIN	3,500	-33,060	-12,460	-7,450	-0,782	-4,685	-9,223
N+3.45	C21	ENVOLVENTE MAX	0,000	-31,040	16,160	5,000	0,816	13,166	30,609
N+3.45	C21	ENVOLVENTE MAX	1,750	-21,970	16,160	5,000	0,816	5,380	2,410
N+3.45	C21	ENVOLVENTE MAX	3,500	-12,890	16,160	5,000	0,816	7,652	17,055
N+3.45	C21	ENVOLVENTE MIN	0,000	-81,280	-11,390	-6,770	-0,866	-16,240	-22,799
N+3.45	C21	ENVOLVENTE MIN	1,750	-69,180	-11,390	-6,770	-0,866	-5,367	-2,947
N+3.45	C21	ENVOLVENTE MIN	3,500	-57,090	-11,390	-6,770	-0,866	-4,552	-25,941
N+3.45	C22	ENVOLVENTE MAX	0	-62,670	11,500	7,110	0,904	19,588	25,091
N+3.45	C22	ENVOLVENTE MAX	1,75	-53,600	11,500	7,110	0,904	7,274	5,733
N+3.45	C22	ENVOLVENTE MAX	3,5	-44,520	11,500	7,110	0,904	15,834	29,390
N+3.45	C22	ENVOLVENTE MIN	0	-111,920	-16,530	-12,110	-0,924	-26,598	-28,481
N+3.45	C22	ENVOLVENTE MIN	1,75	-97,810	-16,530	-12,110	-0,924	-5,546	-0,319
N+3.45	C22	ENVOLVENTE MIN	3,5	-83,700	-16,530	-12,110	-0,924	-5,389	-15,172
N+3.45	C23	ENVOLVENTE MAX	0	-60,340	15,720	11,490	0,975	30,233	30,273
N+3.45	C23	ENVOLVENTE MAX	1,75	-51,270	15,720	11,490	0,975	10,677	3,158
N+3.45	C23	ENVOLVENTE MAX	3,5	-42,200	15,720	11,490	0,975	30,102	7,634
N+3.45	C23	ENVOLVENTE MIN	0	-105,830	-7,460	-20,600	-1,021	-42,008	-18,494
N+3.45	C23	ENVOLVENTE MIN	1,75	-91,720	-7,460	-20,600	-1,021	-6,503	-5,822
N+3.45	C23	ENVOLVENTE MIN	3,5	-77,610	-7,460	-20,600	-1,021	-9,978	-24,740

9.3 VERIFICACIONES

PROYECTO: MARIA INMAULADA
RESISTENCIA A CORTANTE PARA VIGAS
CHEQUEO PARA LA CONDICIÓN DESCRITA EN C.21.3.3.1 (a)

f'c = 21,1 MPa
fy = 420 MPa
ϕ_{corte} = 0,75
Estribos Φ = 9,5 mm
Av = 71 mm²
R = 7,00

PROYECTO: MARIA INMAULADA
RESISTENCIA A CORTANTE PARA VIGAS
CHEQUEO PARA LA CONDICIÓN DESCRITA EN C.21.3.3.1 (a)

$f'c$ =	21,1	MPa
fy =	420	MPa
$\Phi_{cortante}$ =	0,75	
Estribos Φ =	9,5	mm
Av =	71	mm^2
R =	7,00	

Mn = Momentos nominales de la viga en cada extremo restringido de la luz libre.
Vg = Cortante calculado para cargas gravitacionales mayoradas.
Vm = Cortante debido a flexion en curvatura inversa.
Vu = Vm + Vg

V_g	$V_m = M_{ni} + M_{nr} / l_n$															
	COMBO3	COMBO4	COMBO5	COMBO6	COMBO7	COMBO8	COMBO9	COMBO10	COMBO11	COMBO12	COMBO13	COMBO14	COMBO15	COMBO16	COMBO17	COMBO18
(kN)	(kN)															
12,220 13,096	3,179	4,074	3,230	4,420	3,330	3,807	3,708	4,067	2,229	3,424	2,280	3,475	2,588	2,946	2,758	3,116
10,560 16,752	3,488	4,371	3,323	6,400	3,752	6,017	5,877	6,143	3,999	4,885	4,037	4,022	4,265	4,331	4,391	4,656
40,200 34,228	18,020	19,220	18,076	19,275	18,582	18,741	18,337	18,017	13,361	14,860	13,413	14,613	13,719	14,079	13,804	14,254
17,688 21,380	6,261	6,417	6,360	6,525	6,189	6,236	6,550	6,507	4,447	4,602	4,558	4,710	4,375	4,422	4,755	4,782
19,400 25,328	7,320	7,387	7,433	7,500	7,216	7,239	7,590	7,613	3,038	3,115	3,151	3,227	4,094	4,057	3,308	3,331
45,644 40,484	16,860	17,026	17,020	17,108	16,722	16,772	17,284	17,333	12,172	12,338	12,340	12,507	12,034	12,084	12,596	12,645
44,400 45,588	16,060	16,348	16,205	16,377	15,895	15,961	16,660	16,748	11,873	11,137	11,100	11,387	11,705	11,790	12,469	12,555
12,012 13,312	3,314	4,366	3,414	4,466	3,365	3,880	3,890	4,213	2,341	3,301	2,441	3,495	2,592	2,908	2,826	3,242
12,960 13,264	4,801	3,581	4,075	3,655	4,067	3,221	3,234	3,469	3,494	4,274	3,368	4,348	3,680	3,504	3,828	4,182
20,884 36,840	13,116	13,167	13,218	13,269	12,365	12,481	12,708	13,020	8,043	9,094	9,048	10,096	9,182	9,507	9,532	9,847
17,240 13,208	3,060	3,248	3,199	3,307	4,064	3,030	3,427	3,483	3,740	3,828	3,879	4,067	3,640	3,700	4,107	4,183
17,484 14,064	3,188	3,290	3,338	3,440	3,049	3,080	3,349	3,380	3,832	3,853	3,982	4,085	3,682	3,720	4,182	4,223
18,528 13,800	3,907	3,804	3,811	6,019	3,419	3,481	6,135	6,107	4,117	4,324	4,331	4,539	3,859	4,001	4,694	4,717
18,672 13,776	3,283	3,637	3,370	3,825	3,070	3,177	6,030	6,137	3,879	4,234	4,167	4,522	3,667	3,774	4,627	4,794
11,772 13,540	3,368	4,339	3,380	4,331	3,460	3,751	4,168	4,459	2,278	3,349	2,391	3,361	2,470	2,761	3,178	3,470
13,440 13,884	4,111	4,833	4,271	4,908	4,175	4,592	4,714	4,880	2,074	3,694	3,135	3,857	3,208	3,255	3,576	3,765
11,280 16,044	4,707	3,684	4,011	3,888	4,832	3,108	3,490	3,783	3,384	4,361	3,188	4,364	3,488	3,781	4,167	4,460
12,108 13,216	3,131	4,452	3,259	4,560	3,481	3,871	3,840	4,230	2,188	3,469	2,295	3,596	2,518	2,908	2,876	3,267
11,808 13,516	4,034	3,834	4,017	3,899	3,080	3,375	3,358	3,653	3,493	4,475	3,377	4,358	3,759	4,094	4,018	4,312
30,880 33,256	10,356	11,648	10,434	11,749	10,404	11,082	11,020	11,407	7,394	8,885	7,691	8,982	7,832	8,318	8,257	8,645
9,280 11,456	3,421	3,809	3,709	4,007	3,220	3,337	4,181	4,298	2,448	2,837	2,737	3,125	2,248	2,384	3,209	3,325
9,172 11,584	3,667	3,876	3,878	4,184	3,380	3,443	4,409	4,471	2,626	2,835	2,835	3,143	2,339	2,402	3,368	3,430
18,204 20,104	8,743	9,178	9,189	9,624	8,375	8,508	8,861	9,061	6,390	6,825	6,836	7,271	6,022	6,155	7,508	7,638
17,718 20,604	8,228	8,852	8,818	9,343	7,702	8,010	9,751	9,078	5,902	6,717	6,380	7,307	5,557	5,774	7,528	7,743
8,112 8,112	2,276	2,317	2,307	2,348	2,294	2,267	2,337	2,370	1,700	1,741	1,731	1,772	1,678	1,681	1,761	1,794
9,040 7,184	2,182	2,211	2,199	2,238	2,118	2,136	2,275	2,288	1,601	1,660	1,648	1,707	1,567	1,584	1,720	1,740

PROYECTO: MARIA INMAULADA
RESISTENCIA A CORTANTE PARA VIGAS
CHEQUEO PARA LA CONDICIÓN DESCRITA EN C.21.3.3.1 (a)

$f'c$ = 21,1 MPa
fy = 420 MPa
$\Phi_{cortante}$ = 0,75
Estribos Φ = 9,5 mm
Av = 71 mm²
K= 7,00

Vm = [illegible]
Vg = [illegible]
Vm = [illegible]
Vu = Vm + Vg

Vu = Vm + Vg																Vu_{max}	s	ΦVs	ΦVc	ΦVn	ΦVn > Vu_{max}
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
[kN]																[kN]	[m]	[kN]	[kN]	[kN]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	OK
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	OK
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	OK
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	OK
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	OK
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	OK
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	OK
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	OK
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						

PROYECTO: MARIA INMAULADA
RESISTENCIA A CORTANTE PARA VIGAS
CHEQUEO PARA LA CONDICIÓN DESCRITA EN C.21.3.3.1 (a)

F_c = 21,1 MPa
f_y = 420 MPa
$\Phi_{cortante}$ = 0,75
Estribos Φ = 9,5 mm
Av = 71 mm²
R = 7,00

Me = Momentos nominales de la viga en cada extremo restringido de la luz libre.
Vg = Cortante calculado para cargas gravitacionales mayoradas.
Ve = Cortante debido a flexión en curvatura inversa.
Vu = Ve + Vg

COMBO103 = [illegible]
COMBO104 = [illegible]
COMBO105 = [illegible]
COMBO106 = [illegible]
COMBO107 = [illegible]
COMBO108 = [illegible]
COMBO109 = [illegible]
COMBO110 = [illegible]
COMBO111 = [illegible]
COMBO112 = [illegible]
COMBO113 = [illegible]
COMBO114 = [illegible]
COMBO115 = [illegible]
COMBO116 = [illegible]
COMBO117 = [illegible]
COMBO118 = [illegible]

NIVEL	VIGA	LOC.	LONG.	[illegible]			ME						Mu (kN.m) Combinaciones para resistencia [illegible]															
	ELEMENTO No.	(m)	(m)	SECCION	b (m)	d (m)	C.M. (kN.m)	C.V. (kN.m)	SISMO X (kN.m)	SISMO Y (kN.m)	-SISMO X (kN.m)	-SISMO Y (kN.m)	COMBO103	COMBO104	COMBO105	COMBO106	COMBO107	COMBO108	COMBO109	COMBO110	COMBO111	COMBO112	COMBO113	COMBO114	COMBO115	COMBO116	COMBO117	COMBO118
[illegible]	874	0,000	4,000	VIGA20X40	0,20	0,40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	874	4,000					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	875	0,000	3,200	VIGA40X40	0,40	0,40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	875	3,200					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	876	0,000	3,200	VIGA40X40	0,40	0,40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	876	3,200					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	877	0,000	3,200	VIGA40X40	0,40	0,40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	877	3,200					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	878	0,000	3,200	VIGA40X40	0,40	0,40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	878	3,200					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

PROYECTO: MARIA INMAULADA
RESISTENCIA A CORTANTE PARA VIGAS
CHEQUEO PARA LA CONDICIÓN DESCRITA EN C.21.3.3.1 (a)

F_c = 21,1 MPa
f_y = 420 MPa
$\Phi_{cortante}$ = 0,75
Estribos Φ = 9,5 mm
Av = 71 mm²
R = 7,00

Me = Momentos nominales de la viga en cada extremo restringido de la luz libre.
Vg = Cortante calculado para cargas gravitacionales mayoradas.
Ve = Cortante debido a flexión en curvatura inversa.
Vu = Ve + Vg

V_g	$V_e = M_{e1} + M_{e2} / l_n$															
	COMBO103	COMBO104	COMBO105	COMBO106	COMBO107	COMBO108	COMBO109	COMBO110	COMBO111	COMBO112	COMBO113	COMBO114	COMBO115	COMBO116	COMBO117	COMBO118
(kN)	(kN)															
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]																
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]																
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]																
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]																
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4,175																

PROYECTO: MARIA INMAULADA
RESISTENCIA A CORTANTE PARA VIGAS
CHEQUEO PARA LA CONDICIÓN DESCRITA EN C.21.3.3.1 (a)

f'c =	21,1 MPa
fy =	420 MPa
$\Phi_{cortante}$ =	0,75
Estribos Φ =	9,5 mm
Av =	71 mm²
R=	7,00

Mn = Momentos nominales de la viga en cada extremo [illegible] de la luz libre.
Vg = Cortante calculado para cargas gravitacionales mayoradas.
Ve = Cortante debido a flexión en curvatura inversa.
Vu = Ve + Vg

Vu = Ve + Vg																Vu_{max}	S	ΦVs	ΦVc	ΦVn	ΦVn > Vu_{max}
COMBO3	COMBO4	COMBO5	COMBO6	COMBO7	COMBO8	COMBO9	COMBO10	COMBO11	COMBO12	COMBO13	COMBO14	COMBO15	COMBO16	COMBO17	COMBO18						
[kN]																(kN)	(m)	(kN)	(kN)	(kN)	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6,3	0,30	170,82	[illegible]	[illegible]	OK
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0,30	170,82	[illegible]	270,79	OK
7,184	7,184	7,184	7,184	7,184	7,184	7,184	7,184	7,184	7,184	7,184	7,184	7,184	7,184	7,184	7,184						
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0,30	170,82	[illegible]	270,79	OK
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0,30	170,82	[illegible]	270,79	OK
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0,30	170,82	[illegible]	270,79	OK
-4,176	-4,176	-4,176	-4,176	-4,176	-4,176	-4,176	-4,176	-4,176	-4,176	-4,176	-4,176	-4,176	-4,176	-4,176	-4,176						

PROYECTO: MARIA INMACULADA
RESISTENCIA A CORTANTE PARA VIGAS
CHEQUEO PARA LA CONDICIÓN DESCRITA EN C.21.3.3.1 (b)

[illegible]

RESISTENCIA A CORTANTE PARA COLUMNAS
CHEQUEO PARA LA CONDICIÓN DESCRITA EN C.21.3.3.2 (a) - COLUMNA S=40X60 (10/#7 #8 (1.8%))

f'c =	21,1	MPa	Estribos Φ =	9,5	mm
fy =	420	MPa	Av =	71	mm^2
$\Phi_{Columna}$ =	0,75		Cantidad de ramas =	4	
bx =	0,40	m	S =	0,10	m
by =	0,60	m	Recub. =	0,05	m
Lcol =	3,50	m			

C.21.3.3.2(a) El cortante ΦVn no debe ser menor que la suma del cortante debido a flexión en curvatura inversa asociado con el desarrollo de los momentos nominales de la columna en cada extremo restringido de la longitud libre.

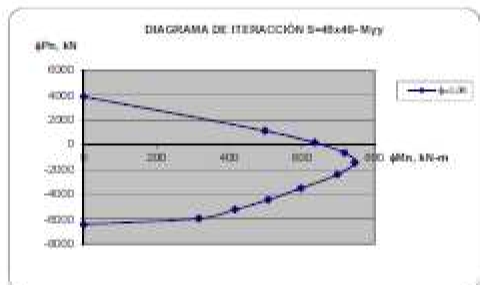
DATOS PARA LOS DIAGRAMAS DE ITERACCIÓN

No.	Curve 1	0. degrees	
	P	M3	M2
1	-6437,00	-34,13	0,00
2	-6001,00	375,40	0,00
3	-6210,00	510,88	0,00
4	-4425,00	628,96	0,00
5	-3511,00	741,72	0,00
6	-2372,00	860,03	0,00
7	-1247,00	927,79	0,00
8	-188,44	892,52	0,00
9	864,65	770,12	0,00
10	2023,42	557,22	0,00
11	3895,15	35,33	0,00

P_{sa} =	180,39	kN
P_{sb} =	156,80	kN
ΦM_{sa} =	818,50	kN-m
ΦM_{sb} =	815,29	kN-m
$V_{diseño}$ =	467,20	kN
ΦV_s =	480,67	kN
ΦV_c =	120,58	kN
ΦV_n =	600,24	kN
$\Phi V_n > V_{diseño}$ =	OK	

DATOS PARA LOS DIAGRAMAS DE ITERACCIÓN

No.	Curve 7	90. degrees	
	P	M3	M2
1	-6437,00	-34,13	0,00
2	-6061,00	-20,00	316,51
3	-6243,00	-17,46	415,56
4	-4442,00	-14,15	507,26
5	-3531,00	-10,24	596,66
6	-2394,00	-3,75	697,92
7	-1442,00	5,26	745,34
8	-641,25	18,44	716,20
9	172,08	28,92	634,74
10	1128,87	35,33	498,16
11	3895,15	35,33	0,00



P_{sa} =	180,36	kN
P_{sb} =	156,17	kN
ΦM_{sa} =	409,34	kN-m
ΦM_{sb} =	596,74	kN-m
$V_{diseño}$ =	313,17	kN
ΦV_s =	482,03	kN
ΦV_c =	125,32	kN
ΦV_n =	618,35	kN
$\Phi V_n > V_{diseño}$ =	OK	

RESISTENCIA A CORTANTE PARA COLUMNAS
CHEQUEO PARA LA CONDICIÓN DESCRITA EN C.21.3.3.2 (b)

f'c =	21,1	MPa	Estribos Φ =	9,5	mm
fy =	420	MPa	Av =	71	mm^2
$\Phi_{Cortante}$ =	0,75		Cantidad de ramas =	4	
bx =	0,40	m	S =	0,10	m
by =	0,60	m	Ω_o=	3,00	
			Recub. =	0,05	m

C.21.3.3.2(b) El cortante ΦVn no debe ser menor que el cortante maximo obtenido de la que incluyan E, con E incrementado por medio de Ωo.

Para cortante V2

Ω_o*$V_{umáx}$ =	43,86	kN
ΦV_s =	469,67	kN
ΦV_c =	120,58	kN
ΦV_n =	590,24	kN
ΦV_n > Ω_o*$V_{umáx}$ =	OK	

Para cortante V3

Ω_o*$V_{umáx}$ =	67,91	kN
ΦV_s =	492,03	kN
ΦV_c =	126,32	kN
ΦV_n =	618,35	kN
ΦV_n > Ω_o*$V_{umáx}$ =	OK	

10 BIBLIOGRAFIA

- Norma Colombiana de Diseño y Construcción Sismo Resistente Ley 400 de 1997 (Modificada Ley 1229 de 2008) y Decreto 926 de Marzo de 2010, Decreto 092 del 17 de Enero de 2011, Decreto 0340 del 13 de Febrero de 2012
- Reglamento para Concreto Estructural ACI 318S-08.

ELABORACIÓN DE DIAGNÓSTICOS, ESTUDIOS TÉCNICOS, AJUSTES A DISEÑOS O DISEÑOS INTEGRALES, CONSTRUCCIÓN Y PUESTA EN FUNCIONAMIENTO DE LAS OBRAS DE INFRAESTRUCTURA EDUCATIVA – UBICADAS EN EL DEPARTAMENTO DE VALLE DEL CAUCA – GRUPO 02

Contrato No. PAF-JU02-G02DC-2015

INFORME CÁLCULO Y ANALISIS ESTRUCTURAL INSTITUCIÓN EDUCATIVA ALFREDO BONILLASEDE No. 2 MARIA INMACULADA (BLOQUE B)

VERSIÒN 0

BOGOTÁ
2017

CONTROL DE REVISIONES

REVISIÓN	FECHA	OBSERVACIONES
1	30/12/16	Primera Redacción

Elaborado por:	Revisado por:	Aprobado por:
Edgar Rolando Barrera Firma:	Javier José Carrillo Ortega Fecha: Enero 2017 Firma:	Director de Interventoría Fecha: Firma:

TABLA DE CONTENIDO

LISTA DE FOTOGRAFÍAS

1 INTRODUCCIÓN

El presente documento contiene las memorias de análisis y diseño estructural correspondiente al proyecto de la “INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMAULADA” ubicado en el municipio de JAMUNDÍ en el departamento de VALLE DEL CAUCA de acuerdo al contrato No. PAF-JU02-G02DC-2015 realizando el estudio de acuerdo a la Norma Colombiana de Diseño y Construcción Sismo Resistente Ley 400 de 1997 (Modificada Ley 1229 de 2008) y Decreto 926 de Marzo de 2010, Decreto 092 del 17 de Enero de 2011, Decreto 0340 del 13 de Febrero de 2012 y en el Reglamento para Concreto Estructural ACI 318S-08.

Para la evaluación de la edificación se ha seguido un proceso normativo que incluye las etapas de inspección, evaluación, pruebas y ensayos, revisión analítica, propuesta de intervención y soluciones constructivas, que tomen en cuenta los aspectos de resistencia, ductilidad, comportamiento y estabilidad de la estructura.

2 DESCRIPCIÓN DEL TRABAJO DE OFICINA

De acuerdo a los planos arquitectónicos y visitas realizadas en campo se procedió al desarrollo del estudio y análisis estructural con la ayuda de diferentes programas tales como ETABS v9.7.4, el cual tiene en cuenta los efectos de segundo orden. Por otro lado se siguieron las recomendaciones descrita en el respectivo estudio de suelos

3 DESCRIPCIÓN DE LOS CRITERIOS BÁSICOS DE DISEÑO

El proyecto se soluciona mediante el diseño de una estructura aporticada, utilizando para el entrepiso del nivel N:-0.05 m placa maciza de espesor e= 0.10 m. La cubierta liviana se compone de perfiles y correas en el nivel N:+3.45 m. Se manejan luces entre 5.00 m y 7.00 m en los dos sentidos de la estructura.

4 NORMAS Y CÓDIGOS A LOS CUALES SE CIÑEN LOS DISEÑOS

El diseño de todas las estructuras se realizó basado en la Norma Colombiana de Diseño y Construcción Sismo Resistente Ley 400 de 1997 (Modificada Ley 1229 de 2008) y Decreto 926 de Marzo de 2010, Decreto 092 del 17 de Enero de 2011, Decreto 0340 del 13 de Febrero de 2012 y en el Reglamento para Concreto Estructural ACI 318S-08.

5 DESCRIPCIÓN DE LA METODOLOGÍA DE DISEÑO EMPLEADA.

El proyecto se soluciona mediante el diseño de una estructura aporticada, utilizando para el entrepiso del nivel N:-0.05 m placa maciza de espesor e= 0.10, La cubierta liviana se compone de perfiles y correas en el nivel N:+3.45 m. Se manejan luces entre 5.00 m y 7.00 m en los dos sentidos de la estructura.

Las cargas horizontales fueron distribuidas entre los diferentes pórticos en proporción a su rigidez y teniendo en cuenta los efectos de torsión.

El dimensionamiento dado a todos los elementos que intervienen en las estructuras satisfacen los requerimientos de solicitación ocasionados por las derivas presentes. Las cargas vivas de diseño son: **0.35 kN/ m²** para cubiertas.

Para la cimentación se siguieron las recomendaciones descritas en el respectivo estudio de suelos, que recomienda apoyar la estructura a **-1.50 m** del nivel de la placa aérea de cimentación, apoyando las zapatas a **-1.50 m**, según lo indicado en los planos estructurales. La capacidad portante de seguridad admisible del suelo es **0.12 MPa** y el tipo de suelo es **E**.

6 DESCRIPCIÓN Y ANÁLISIS DE LAS CONDICIONES EXISTENTES

El sitio donde se procederá a la construcción de la estructura se encuentra ubicado una edificación existente, como se evidenciara en las fotos mostradas a continuación.

1Fotografía Estructura existente

Fuente: Propia

2Fotografía Estructura existente

Fuente: Propia

3 Fotografía Estructura existente

Fuente: Propia

4 Fotografía Estructura existente

Fuente: Propia

MEMORIAL DE RESPONSABILIDAD

JAMUNDÌ, Agosto de 2017.

Señores

PLANEACION MUNICIPAL
La Ciudad

Yo, **EDGAR ROLANDO BARRERA,** ingeniero civil con Matrícula Profesional Nº **15202-102710** de **BOYACÁ,** debidamente registrado en el consejo profesional de Ingeniería y Arquitectura de Boyacá, presento los cálculos y diseños estructurales elaborados de acuerdo a los requerimientos de la **NORMA COLOMBIANA DE DISEÑO Y CONSTRUCCIÓN SISMO RESISTENTE LEY 400 DE 1997 (MODIFICADA LEY 1229 DE 2008) Y DECRETO 926 DE MARZO DE 2010**, para el proyecto **JORNADA ÚNICA DEL MINISTERIO DE EDUCACIÓN- MODULO 2. INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMAULADA**, declaro que asumo la responsabilidad por los perjuicios que causa de ellos puedan deducirse, exonerando a la PLANEACION MUNICIPAL de cualquier responsabilidad.

Acepto y reconozco que la revisión efectuada por PLANEACION URBANA no constituye una aprobación al Diseño Estructural, sino una verificación del cumplimiento de la **NORMA COLOMBIANA DE DISEÑO Y CONSTRUCCIÓN SISMO RESISTENTE**.

Atentamente,

____

EDGAR ROLANDO BARRERA

ING. ESTRUCTURAL

T.P. 15202-102710 BYC


REPUBLICA DE COLOMBIA
CONSEJO PROFESIONAL NACIONAL DE INGENIERIA
Y SUS PROFESIONES AUXILIARES
INGENIERO CIVIL
BARRERA SALINAS
EDGAR ROLANDO
UNIVERSIDAD PEDAGOGICA Y
TECNOLOGICA DE COLOMBIA
PRESIDENTE DEL CONSEJO

7 MEMORIA DE CÁLCULO

7.1 AVALUO DE CARGAS

1. CUBIERTA LIVIANA

Teja termo-acústica			0,10 kN/m²
Estructura metálica de soporte			0,10 kN/m²
Acabados e iluminacion			0,10 kN/m²
		CM	0,30 kN/m²
	Tabla 4.2.1-2 de NSR-10 (Caso F)	CV	0,35 kN/m²
		CR	0,65 kN/m²
Muros culata	0.5x0.15x13		0,98 kN/m

CU = 1.2x0.3+1.6x0.35 = ***0,9 kN/m²***

Espesor de placa equivalente:

e=CM/24 0,013 m

Pendiente de Cubierta α (º) = **17,000** ⟶ Equivale a 30.6%

B.4.8.3 de NSR-10 (Carga de granizo) CV

Según la tabla B.4.2.1-2 - En cubiertas inclinadas con menos de 15º de pendiente en estructura metálica o de madera la carga viva asumida puede ser 1 kN/m^2.
Según B.4.8.3.1 - Las cargas de granizo deben tenerse en cuenta en las regiones del país con más de 2.000 metros de altura sobre el nivel del mar o en lugares de menor altura donde la autoridad municipal o distrital así lo exija.
Según B.4.8.3.2 - Para cubiertas con inclinación mayor a 15% el valor de la carga viva para granizo puede reducirse a 0.5 kN/m^2.

7.1.1 AVALÚO DE CARGAS DE VIENTO ANÁLISIS SIMPLIFICADO (sprfv)

Para que le análisis se pueda realizar mediante el método de diseño simplificado se requiere que se cumpla con lo establecido por la NSR-10 titulo B.6.4.1.1. y B.6.4.1.2.

a - El edificio sea de diafragma simple como se define en la sección
B.6.2. b - El edificio sea bajo de acuerdo con lo establecido con la
sección B.6.2.
c - El edificio sea cerrado como se define en la sección B.6.2. y cumpla las provisiones de zonas propensas a huracanes de acuerdo con la sección B.6.5.9.3.
d - El edificio sea de forma regular como se define en la sección B.6.2.
e - El edificio no sea clasificado como flexible como se define en la sección B.6.2.
f - Las características de respuesta del edificio sean tales que el mismo no esté sujeto a las cargas por viento a travéz de él, a generación de vórtices, a inestabilidad por golpeteo o aleteo, y no esté ubicado en un sitio en el que se puedan presentar efectos de canalización
o sacudimiento por la estela de obstrucciones en barlovento, que obliguen a concideraciones especiales.
g - El edificio tenga una sección transversal aproximadamente simétrica en cada dirección y tenga una cubierta plana o cubierta a dos o cuatro aguas con ángulo de inclinación $\emptyset \leq \varkappa\varrho°$
h - El edificio esta eximido de los casos de carga torsional indicados en la nota 5 de la figura B.6.5.7. o estos casos no conctrolan el diseño de ninguno de los elementos del SPRFV del edificio.

De los anteriores parametros se observa que la edificación cumple con lo estipulado, por lo

tanto: Tipo de análisis permitido: ANÁLISIS SIMPLIFICADO

Entonces:

$$Ps = \lambda KztIPs_{10}$$

Donde:

λ=	Factor de ajuste por altura y exposición, figura B.6.4.2.
K_{zt}=	Factor topográfico como se define en la sección B.6.5.7. evaluado a la altura promedio de la cubierta,
h, B.6.5.1. I=	Factor de importancia como se define en la sección B.6.5.5.
P_{s10}=	Presión de viento de diseño simplificado para la categoria de exposición B, con h=10 m de la figura B.6.4.2.

	CIUDAD	ZONA	VELOCIDAD DEL VIENTO
Zona de amenza eólica=	JAMUNDÍ	3	100 Km/h

Luego:

λ=	1,0
K_{zt}=	1,0
I=	1,0
P_{s10}=	0,13

Según B.6.4.2.1.1. Presiones mínimas: Los efectos de carga de las presiones de viento de diseño de la sección B.6.4.2.1. no serán menores que el caso de carga mínima de la sección B.6.1.3.1. suponiendo presiones Ps, de +0.40 kN/m^2 para las zonas de A, B, C y D y de
0.00 kN/m^2 paras las zonas E, F, G y H.

Por lo tanto la carga de viento a emplear es: 0,40 kN/m^2

7.2 ANALISIS SISMICO

7.2.1 ANÁLISIS SÍSMICO (ESPECTRO DE DISEÑO NSR-10)

ZONA DE AMENAZA SÍSMICA
ALTA

EFECTOS LOCALES

Perfil de Suelo	E
Coeficiente Aa	0,25
Coeficiente Av	0,25

COEFICIENTE DE IMPORTANCIA

Grupo de Uso	III
Coeficiente de importancia I	1,25

PERIODO FUNDAMENTAL DE LA EDIFICACIÓN

$T_a = C_t h^{\alpha}$		
C_t =	0,047	
h =	3,50	m
α =	0,90	
T_a=	0,15	Seg

VARIACIÓN COEFICIENTE DE CAPACIDAD DE DISIPACIÓN DE ENERGÍA

Ro: Coeficiente de capacidad de disipación de energía básico
R: Coeficiente de capacidad de disipación de energía, para ser empleado en el diseño.
ϕ_a: Coeficiente de reducción de R causado por irregularidades en altura de la edificación
ϕ_p: Coeficiente de reducción de R causado por irregularidades en planta de la edificación
ϕ_r: Coeficiente de reducción de R causado por ausencia de redundancia en el sistema estructural de resistencia sísmica

Ro	7,00
ϕ_a	1,00
ϕ_p	1,00
ϕ_r	1,00
ϕ	1,00
R	7,00

TIPO	DESCRIPCIÓN	VALOR
	N.A	ϕ_p: 1.00
	N.A	ϕ_a: 1.00
	AUSENCIA DE REDUNDANCIA	ϕ_r: 1.00
	UNIONES SOLDADAS	ϕ: 1.00

ESPECTRO DE DISEÑO (AMORTIGUAMIENTO ξ=5% DEL CRÍTICO)

Fa: Factor de ampliación de la aceleración.
Fv: Factor de ampliación de la aceleración en el rango de velocidades constantes.
Sa: Valor del espectro de aceleraciones de diseño para un periodo de vibración dado.
Aa: Coeficiente que representa la aceleración horizontal pico efectiva para diseño.
Av: Coeficiente que representa la velocidad horizontal pico efectiva para diseño.
T: Periodo de vibración del sistema elástico, en segundos.
T_C: Periodo de vibración, en segundos, correspondiente a la transición entre la zona de aceleración constante del espectro de diseño, para periodos cortos, y la parte descendiente del mismo.
T_L: Periodo de vibración, en segundos, correspondiente al inicio de la zona de desplazamiento aproximadamente constante del espectro de diseño para periodos largos.

ZONA DE AMENAZA ALTA

T_o:	0,21	Seg
T_C:	0,99	Seg
T_L:	7,20	Seg
Aa:	0,25	
Av:	0,25	
Fa:	1,45	
Fv:	3,00	

T	Sa	Sa/$R_{adoptado}$
(Seg)	(%g)	(%g)
0,00	1,133	0,162
0,05	1,133	0,162
0,10	1,133	0,162
0,16	1,133	0,162
0,21	1,133	0,162
0,40	1,133	0,162
0,60	1,133	0,162
0,80	1,133	0,162
0,99	1,133	0,162
1,34	0,841	0,120
1,68	0,669	0,096
2,03	0,555	0,079
2,37	0,474	0,068
2,72	0,414	0,059
3,06	0,367	0,052
3,41	0,330	0,047
3,75	0,300	0,043
4,10	0,275	0,039
4,44	0,253	0,036
4,79	0,235	0,034
5,13	0,219	0,031
5,48	0,205	0,029
5,82	0,193	0,028
6,17	0,182	0,026
6,51	0,173	0,025
6,86	0,164	0,023
7,20	0,156	0,022
8,20	0,120	0,017
9,20	0,096	0,014

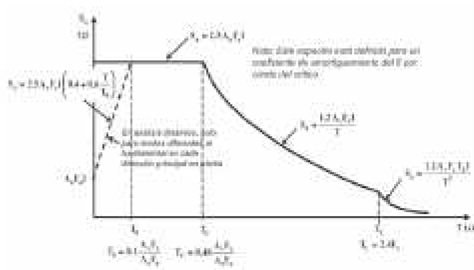
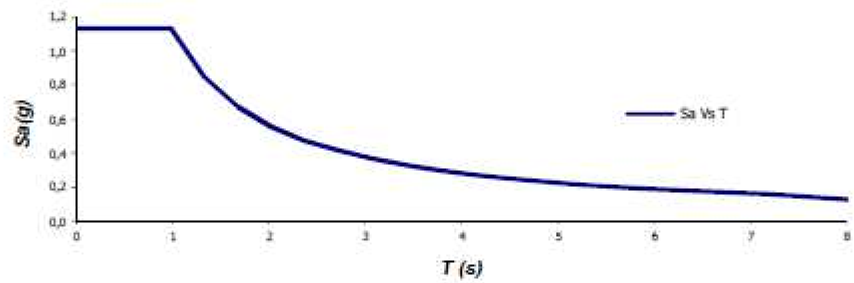
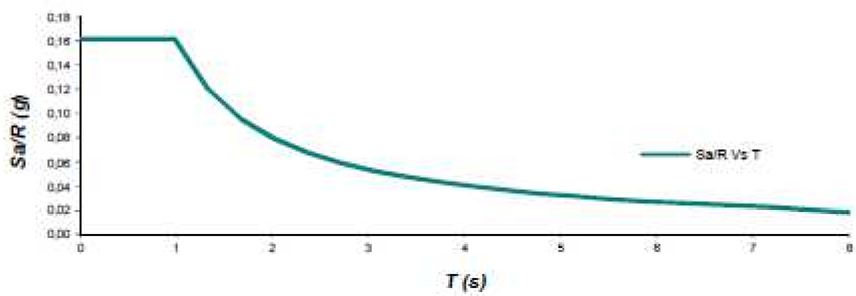


Figura A.2.6-1 — Espectro Elástico de Aceleraciones de Diseño como fracción de g

Espectro Elástico de Diseño



Espectro Elástico de Diseño/R_{adop}



Sistema de resistencia Sísmica: Pórticos resistentes a momentos con Capacidad Especial de Disipación de Energía (DES).

Nota: El sistema de pórtico es un sistema estructural compuesto por un pórtico espacial, resistente a momentos, esencialmente completo, sin diagonales, que resiste todas las cargas verticales y las fuerzas horizontales.

MODELO MATEMÁTICO

Modelo Tridimensional con Diafragma Rígido: En este modelo los entrepisos se consideran diafragmas infinitamente rígidos en su propio plano. La masa de cada diafragma se considera concentrada en su centro de masa. Los efectos torsionales accidentales son incluidos haciendo ajustes en la localización de los centros de masa de los diafragmas.
Los efectos direccionales son tomados en cuenta a través de las componentes de los desplazamientos de los grados de libertad horizontales ortogonales del diafragma.

7.2.2 ANÁLISIS SÍSMICO (ESPECTRO DE UMBRAL DE DAÑO NSR-10)

ZONA DE AMENAZA SÍSMICA
ALTA

EFECTOS LOCALES

Perfil de Suelo	E
Coeficiente Ad	0,09
Coeficiente Fv	3,50

COEFICIENTE DE IMPORTANCIA

Grupo de Uso	III
Coeficiente de importancia I	1,25
Coeficiente de Sitio Ŝ:	4,38

ESPECTRO DE UMBRAL DE DAÑO (AMORTIGUAMIENTO ξ=2% DEL CRÍTICO)

Sad: Valor del espectro de aceleraciones del umbral de daño para un periodo de vibración dado.
Ad: Máxima aceleración pico efectiva para el umbral de daño.
T: Periodo de vibración del sistema elástico, en segundos.
T_{Cd}: Periodo de vibración, en segundos, correspondiente a la transición entre la zona de aceleración constante del espectro sísmico del umbral de daño, para periodos cortos, y la parte descendiente del mismo.
T_{Ld}: Periodo de vibración, en segundos, correspondiente a la transición entre la zona de desplazamiento constante del espectro sísmico del umbral de daño, para periodos largos.

Ad: 0,09
T_{Cd}: 2,19 Seg
T_{Ld}: 10,5 Seg

T (Seg)	Sad (%g)
0,00	0,090
0,05	0,126
0,10	0,162
0,15	0,198
0,20	0,234
0,25	0,270
0,49	0,270
0,73	0,270
0,98	0,270
1,22	0,270
1,46	0,270
1,70	0,270
1,95	0,270

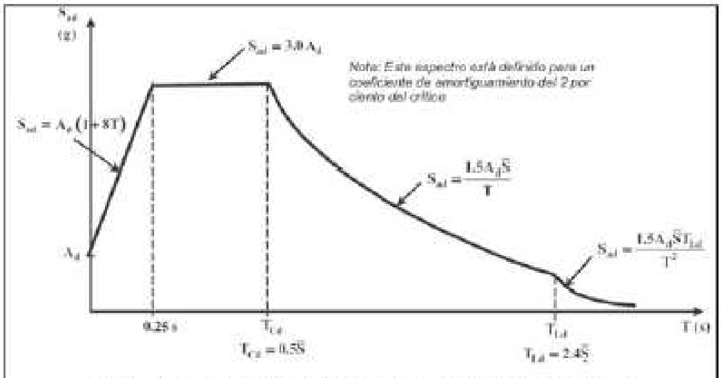
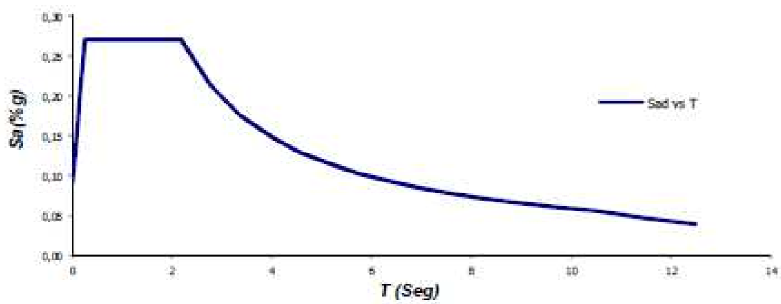


Figura A.12.3-1 — Espectro de aceleraciones horizontales elástico del umbral de daño

2,19	0,270
2,78	0,212
3,38	0,175
3,97	0,149
4,56	0,129
5,16	0,115
5,75	0,103
6,34	0,093
6,94	0,085
7,53	0,078
8,13	0,073
8,72	0,068
9,31	0,063
9,91	0,060
10,50	0,056
11,50	0,047
12,50	0,040

Espectro Del Umbral de Daño



Sistema de resistencia Sísmica: Pórticos resistentes a momentos con Capacidad Especial de Disipación de Energía (DES).

Nota: El sistema de pórtico es un sistema estructural compuesto por un pórtico espacial, resistente a momentos, esencialmente completo, sin diagonales, que resiste todas las cargas verticales y las fuerzas horizontales.

MODELO MATEMÁTICO

Modelo Tridimensional con Diafragma Rígido: En este modelo los entrepisos se consideran diafragmas infinitamente rigidos en su propio plano. La masa de cada diafragma se considera concentrada en su centro de masa. Los efectos torsionales accidentales son incluidos haciendo ajustes en la localización de los centros de masa de los diafragmas.
Los efectos direccionales son tomados en cuenta a través de las componentes de los desplazamientos de los grados de libertad horizontales ortogonales del diafragma.

7.2.3 CALCULO DEL CORTANTE BASAL DE LA ESTRUCTURA (ESPECTRO DE DISEÑO NSR-10)

CALCULO DEL CORTANTE BASAL DE LA ESTRUCTURA

$H_{edificio}$ =	3,50	m	
Tipo de Perfil:	E		
Aa =	0,25		
Av =	0,25		
Fa =	1,45		
Fv =	3,00		
T_c =	0,99	Seg	
C_t =	0,047		
α =	0,90		
T_a =	0,15	Seg	
C_u =	1,20		
$C_u T_a$ =	0,17	Seg	
modelación estructural =	0,15	Seg	
ΔT =	3,36	%	Ok!
$T_{adoptado}$ =	0,15	Seg	
S_a =	1,133		S_a obtenido del espectro de diseño
g =	9,81	m/s^2	
M =	69,02	Ton	Masa obtenida del modelo
V_s =	767,18	kN	
90% Vs =	690,46	kN	Cortante basal para comparación de acuerdo a A.5.4.5

MODELO INICIAL

Response Espectrum Base Reactions

PORCENTAJE PARA REVISIÓN DE CORTANTE BASAL DE ACUERDO A A.5.4.5 NSR-10: 90,

	F1	F2	Total	Factor		g corre
$V_{s(x)}$ =	612,07	0	612,07	1,128	11,066	Se apl:
$V_{s(y)}$ =	0	606,22	606,22	1,139	11,173	Se apl:

MODELO CORREGIDO

Response Espectrum Base Reactions

	F1	F2	Total	90% Vs
$V_{s(x)}$ =	690,44	0	690,44	690,5
$V_{s(y)}$ =	0	690,45	690,45	690,5

7.2.4 CALCULO DEL CORTANTE BASAL DE LA ESTRUCTURA (ESPECTRO DE UMBRAL DE DAÑO NSR-10)

CALCULO DEL CORTANTE BASAL DE LA ESTRUCTURA (ESPECTRO DE UMBRAL DE DAÑO NSR-

CALCULO DEL CORTANTE BASAL DE LA ESTRUCTURA

$H_{edificio}$ =	3,50	m	
Tipo de Perfil:	E		
Ad =	0,09		
Fv =	0,40		
C_t =	0,047		
α =	0,90		
T_a =	0,15	Seg	
C_u =	1,20		
$C_u T_a$ =	0,17	Seg	
$T_{modelación\ estructural}$ =	0,15	Seg	
ΔT =	3,36	è	Ok!
$T_{adoptado}$ =	0,15	Seg	
S_a =	0,270		S_a obtenido del espectro de diseño
g =	9,81	m/s^2	
M =	69,02	Ton	Masa obtenida del modelo
V_s =	182,82	kN	

MODELO INICIAL

Response Espectrum Base Reactions

PORCENTAJE PARA REVISIÓN DE CORTANTE BASAL DE ACUERDO A A.5.4.5 NSR-10:

	F1	F2	Total	Factor		g c
$V_{s(x)}$=	102,02	0	102,02	1,792	17,580	Se
$V_{s(y)}$=	0	97,6	97,60	1,873	18,376	Se

MODELO CORREGIDO

Response Espectrum Base Reactions

	F1	F2	Total	100% Vs
$V_{s(x)}$=	182,83	0	182,83	182,8
$V_{s(y)}$=	0	182,82	182,82	182,8

7.2.5 CÁLCULO DE DERIVAS MÁXIMAS

CALCULO DE DERIVAS MAXIMAS

ALTURA DE N+5.93	0,59	m
ALTURA DE N+5.34	1,39	m
ALTURA DE N+3.95	0,50	m
ALTURA DE N+3.45	3,50	m
ALTURA DE BASE	0,00	m
ALTURA DE	0,00	m

Deriva Máxima Permitida 1,00 %

Nivel	Punto	COMBINACIÓN DE CARGA	DESPLAZAMIENTOS FUERZA SÍSMICA Desplazamiento X	Desplazamiento Y	Deriva Δ m	Deriva Δ %	Observación
N+3.45	1	COMDER1 MAX	0,0069	0,0025	0,00734	0,21	OK
N+3.45	1	COMDER1 MIN	-0,0069	-0,0025	0,00734	0,21	OK
N+3.45	1	COMDER2 MAX	0,0042	0,0041	0,00587	0,17	OK
N+3.45	1	COMDER2 MIN	-0,0042	-0,0041	0,00587	0,17	OK
BASE	1	COMDER1 MAX	0	0	—	—	—
BASE	1	COMDER1 MIN	0	0	—	—	—
BASE	1	COMDER2 MAX	0	0	—	—	—
BASE	1	COMDER2 MIN	0	0	—	—	—
N+3.45	2	COMDER1 MAX	0,0069	0,0021	0,00721	0,21	OK
N+3.45	2	COMDER1 MIN	-0,0069	-0,0021	0,00721	0,21	OK
N+3.45	2	COMDER2 MAX	0,0042	0,0034	0,00540	0,15	OK
N+3.45	2	COMDER2 MIN	-0,0042	-0,0034	0,00540	0,15	OK
BASE	2	COMDER1 MAX	0	0	—	—	—
BASE	2	COMDER1 MIN	0	0	—	—	—
BASE	2	COMDER2 MAX	0	0	—	—	—
BASE	2	COMDER2 MIN	0	0	—	—	—
N+3.45	3	COMDER1 MAX	0,0069	0,003	0,00752	0,21	OK
N+3.45	3	COMDER1 MIN	-0,0069	-0,003	0,00752	0,21	OK
N+3.45	3	COMDER2 MAX	0,0042	0,0042	0,00594	0,17	OK
N+3.45	3	COMDER2 MIN	-0,0042	-0,0042	0,00594	0,17	OK
BASE	3	COMDER1 MAX	0	0	—	—	—
BASE	3	COMDER1 MIN	0	0	—	—	—
BASE	3	COMDER2 MAX	0	0	—	—	—
BASE	3	COMDER2 MIN	0	0	—	—	—
N+3.45	4	COMDER1 MAX	0,0069	0,0047	0,00835	0,24	OK
N+3.45	4	COMDER1 MIN	-0,0069	-0,0047	0,00835	0,24	OK
N+3.45	4	COMDER2 MAX	0,0042	0,006	0,00732	0,21	OK
N+3.45	4	COMDER2 MIN	-0,0042	-0,006	0,00732	0,21	OK
BASE	4	COMDER1 MAX	0	0	—	—	—
BASE	4	COMDER1 MIN	0	0	—	—	—
BASE	4	COMDER2 MAX	0	0	—	—	—
BASE	4	COMDER2 MIN	0	0	—	—	—
N+3.45	6	COMDER1 MAX	0,0052	0,0025	0,00577	0,16	OK
N+3.45	6	COMDER1 MIN	-0,0052	-0,0025	0,00577	0,16	OK
N+3.45	6	COMDER2 MAX	0,0035	0,0041	0,00539	0,15	OK
N+3.45	6	COMDER2 MIN	-0,0035	-0,0041	0,00539	0,15	OK
BASE	6	COMDER1 MAX	0	0	—	—	—
BASE	6	COMDER1 MIN	0	0	—	—	—
BASE	6	COMDER2 MAX	0	0	—	—	—
BASE	6	COMDER2 MIN	0	0	—	—	—
N+3.45	7	COMDER1 MAX	0,0052	0,0021	0,00561	0,16	OK
N+3.45	7	COMDER1 MIN	-0,0052	-0,0021	0,00561	0,16	OK
N+3.45	7	COMDER2 MAX	0,0035	0,0034	0,00488	0,14	OK
N+3.45	7	COMDER2 MIN	-0,0035	-0,0034	0,00488	0,14	OK
BASE	7	COMDER1 MAX	0	0	—	—	—
BASE	7	COMDER1 MIN	0	0	—	—	—
BASE	7	COMDER2 MAX	0	0	—	—	—
BASE	7	COMDER2 MIN	0	0	—	—	—
N+3.45	8	COMDER1 MAX	0,0052	0,003	0,00600	0,17	OK
N+3.45	8	COMDER1 MIN	-0,0052	-0,003	0,00600	0,17	OK
N+3.45	8	COMDER2 MAX	0,0035	0,0042	0,00547	0,16	OK
N+3.45	8	COMDER2 MIN	-0,0035	-0,0042	0,00547	0,16	OK
BASE	8	COMDER1 MAX	0	0	—	—	—
BASE	8	COMDER1 MIN	0	0	—	—	—
BASE	8	COMDER2 MAX	0	0	—	—	—
BASE	8	COMDER2 MIN	0	0	—	—	—
N+3.45	9	COMDER1 MAX	0,0052	0,0047	0,00701	0,20	OK
N+3.45	9	COMDER1 MIN	-0,0052	-0,0047	0,00701	0,20	OK
N+3.45	9	COMDER2 MAX	0,0035	0,006	0,00695	0,20	OK
N+3.45	9	COMDER2 MIN	-0,0035	-0,006	0,00695	0,20	OK
BASE	9	COMDER1 MAX	0	0	—	—	—
BASE	9	COMDER1 MIN	0	0	—	—	—
BASE	9	COMDER2 MAX	0	0	—	—	—
BASE	9	COMDER2 MIN	0	0	—	—	—
N+3.45	11	COMDER1 MAX	0,0052	0,0025	0,00577	0,16	OK
N+3.45	11	COMDER1 MIN	-0,0052	-0,0025	0,00577	0,16	OK
N+3.45	11	COMDER2 MAX	0,0057	0,0041	0,00702	0,20	OK
N+3.45	11	COMDER2 MIN	-0,0057	-0,0041	0,00702	0,20	OK
BASE	11	COMDER1 MAX	0	0	—	—	—
BASE	11	COMDER1 MIN	0	0	—	—	—
BASE	11	COMDER2 MAX	0	0	—	—	—
BASE	11	COMDER2 MIN	0	0	—	—	—
N+3.45	12	COMDER1 MAX	0,0052	0,0021	0,00561	0,16	OK
N+3.45	12	COMDER1 MIN	-0,0052	-0,0021	0,00561	0,16	OK
N+3.45	12	COMDER2 MAX	0,0057	0,0034	0,00664	0,19	OK
N+3.45	12	COMDER2 MIN	-0,0057	-0,0034	0,00664	0,19	OK
BASE	12	COMDER1 MAX	0	0	—	—	—
BASE	12	COMDER1 MIN	0	0	—	—	—
BASE	12	COMDER2 MAX	0	0	—	—	—
BASE	12	COMDER2 MIN	0	0	—	—	—

CÁLCULO DE DERIVAS MÁXIMAS

ALTURA DE N+[illegible]	0,59	m
ALTURA DE N+[illegible]	1,39	m
ALTURA DE N+[illegible]	0,50	m
ALTURA DE N+[illegible]	3,50	m
ALTURA DE BASE	0,00	m
ALTURA DE	0,00	m

Deriva Máxima Permitida 1,00 %

Nivel	Punto	COMBINACIÓN DE CARGA	DESPLAZAMIENTOS FUERZA SÍSMICA		Deriva Δ /	Deriva Δ %	Observación
			Desplazamiento X	Desplazamiento Y			
N+3.45	13	COMDER1 MAX	0,0052	0,003	0,00600	0,17	OK
N+3.45	13	COMDER1 MIN	-0,0052	-0,003	0,00600	0,17	OK
N+3.45	13	COMDER2 MAX	0,0057	0,0042	0,00708	0,20	OK
N+3.45	13	COMDER2 MIN	-0,0057	-0,0042	0,00708	0,20	OK
BASE	13	COMDER1 MAX	0	0	--	--	--
BASE	13	COMDER1 MIN	0	0	--	--	--
BASE	13	COMDER2 MAX	0	0	--	--	--
BASE	13	COMDER2 MIN	0	0	--	--	--
N+3.45	14	COMDER1 MAX	0,0052	0,0047	0,00701	0,20	OK
N+3.45	14	COMDER1 MIN	-0,0052	-0,0047	0,00701	0,20	OK
N+3.45	14	COMDER2 MAX	0,0057	0,006	0,00828	0,24	OK
N+3.45	14	COMDER2 MIN	-0,0057	-0,006	0,00828	0,24	OK
BASE	14	COMDER1 MAX	0	0	--	--	--
BASE	14	COMDER1 MIN	0	0	--	--	--
BASE	14	COMDER2 MAX	0	0	--	--	--
BASE	14	COMDER2 MIN	0	0	--	--	--

CÁLCULO DE DERIVAS MÁXIMAS (ESPECTRO DE UMBRAL DE DAÑO)

ALTURA DE N+5.93	0,59	m		Deriva Máxima Permitida	0,40	%
ALTURA DE N+5.34	1,39	m				
ALTURA DE N+3.95	0,50	m				
ALTURA DE N+3.45	3,50	m				
ALTURA DE BASE	0,00	m				
ALTURA DE	0,00	m				

Nivel	Punto	COMBINACIÓN DE CARGA	DESPLAZAMIENTOS FUERZA SÍSMICA Desplazamiento X	Desplazamiento Y	Deriva Δ m	Deriva Δ %	Observación
N+3.45	1	COMDERUMB1 MAX	0,0018	0,0006	0,00190	0,05	OK
N+3.45	1	COMDERUMB1 MIN	-0,0018	-0,0006	0,00190	0,05	OK
N+3.45	1	COMDERUMB2 MAX	0,0011	0,001	0,00149	0,04	OK
N+3.45	1	COMDERUMB2 MIN	-0,0011	-0,001	0,00149	0,04	OK
BASE	1	COMDERUMB1 MAX	0	0	—	—	—
BASE	1	COMDERUMB1 MIN	0	0	—	—	—
BASE	1	COMDERUMB2 MAX	0	0	—	—	—
BASE	1	COMDERUMB2 MIN	0	0	—	—	—
N+3.45	2	COMDERUMB1 MAX	0,0018	0,0005	0,00187	0,05	OK
N+3.45	2	COMDERUMB1 MIN	-0,0018	-0,0005	0,00187	0,05	OK
N+3.45	2	COMDERUMB2 MAX	0,0011	0,0009	0,00142	0,04	OK
N+3.45	2	COMDERUMB2 MIN	-0,0011	-0,0009	0,00142	0,04	OK
BASE	2	COMDERUMB1 MAX	0	0	—	—	—
BASE	2	COMDERUMB1 MIN	0	0	—	—	—
BASE	2	COMDERUMB2 MAX	0	0	—	—	—
BASE	2	COMDERUMB2 MIN	0	0	—	—	—
N+3.45	3	COMDERUMB1 MAX	0,0018	0,0008	0,00197	0,06	OK
N+3.45	3	COMDERUMB1 MIN	-0,0018	-0,0008	0,00197	0,06	OK
N+3.45	3	COMDERUMB2 MAX	0,0011	0,0011	0,00156	0,04	OK
N+3.45	3	COMDERUMB2 MIN	-0,0011	-0,0011	0,00156	0,04	OK
BASE	3	COMDERUMB1 MAX	0	0	—	—	—
BASE	3	COMDERUMB1 MIN	0	0	—	—	—
BASE	3	COMDERUMB2 MAX	0	0	—	—	—
BASE	3	COMDERUMB2 MIN	0	0	—	—	—
N+3.45	4	COMDERUMB1 MAX	0,0018	0,0012	0,00216	0,06	OK
N+3.45	4	COMDERUMB1 MIN	-0,0018	-0,0012	0,00216	0,06	OK
N+3.45	4	COMDERUMB2 MAX	0,0011	0,0015	0,00186	0,05	OK
N+3.45	4	COMDERUMB2 MIN	-0,0011	-0,0015	0,00186	0,05	OK
BASE	4	COMDERUMB1 MAX	0	0	—	—	—
BASE	4	COMDERUMB1 MIN	0	0	—	—	—
BASE	4	COMDERUMB2 MAX	0	0	—	—	—
BASE	4	COMDERUMB2 MIN	0	0	—	—	—
N+3.45	6	COMDERUMB1 MAX	0,0014	0,0006	0,00152	0,04	OK
N+3.45	6	COMDERUMB1 MIN	-0,0014	-0,0006	0,00152	0,04	OK
N+3.45	6	COMDERUMB2 MAX	0,0009	0,001	0,00135	0,04	OK
N+3.45	6	COMDERUMB2 MIN	-0,0009	-0,001	0,00135	0,04	OK
BASE	6	COMDERUMB1 MAX	0	0	—	—	—
BASE	6	COMDERUMB1 MIN	0	0	—	—	—
BASE	6	COMDERUMB2 MAX	0	0	—	—	—
BASE	6	COMDERUMB2 MIN	0	0	—	—	—
N+3.45	7	COMDERUMB1 MAX	0,0014	0,0005	0,00149	0,04	OK
N+3.45	7	COMDERUMB1 MIN	-0,0014	-0,0005	0,00149	0,04	OK
N+3.45	7	COMDERUMB2 MAX	0,0009	0,0009	0,00127	0,04	OK
N+3.45	7	COMDERUMB2 MIN	-0,0009	-0,0009	0,00127	0,04	OK
BASE	7	COMDERUMB1 MAX	0	0	—	—	—
BASE	7	COMDERUMB1 MIN	0	0	—	—	—
BASE	7	COMDERUMB2 MAX	0	0	—	—	—
BASE	7	COMDERUMB2 MIN	0	0	—	—	—
N+3.45	8	COMDERUMB1 MAX	0,0014	0,0008	0,00161	0,05	OK
N+3.45	8	COMDERUMB1 MIN	-0,0014	-0,0008	0,00161	0,05	OK
N+3.45	8	COMDERUMB2 MAX	0,0009	0,0011	0,00142	0,04	OK
N+3.45	8	COMDERUMB2 MIN	-0,0009	-0,0011	0,00142	0,04	OK
BASE	8	COMDERUMB1 MAX	0	0	—	—	—
BASE	8	COMDERUMB1 MIN	0	0	—	—	—
BASE	8	COMDERUMB2 MAX	0	0	—	—	—
BASE	8	COMDERUMB2 MIN	0	0	—	—	—
N+3.45	9	COMDERUMB1 MAX	0,0014	0,0012	0,00184	0,05	OK
N+3.45	9	COMDERUMB1 MIN	-0,0014	-0,0012	0,00184	0,05	OK
N+3.45	9	COMDERUMB2 MAX	0,0009	0,0015	0,00175	0,05	OK
N+3.45	9	COMDERUMB2 MIN	-0,0009	-0,0015	0,00175	0,05	OK
BASE	9	COMDERUMB1 MAX	0	0	—	—	—
BASE	9	COMDERUMB1 MIN	0	0	—	—	—
BASE	9	COMDERUMB2 MAX	0	0	—	—	—
BASE	9	COMDERUMB2 MIN	0	0	—	—	—
N+3.45	11	COMDERUMB1 MAX	0,0013	0,0006	0,00143	0,04	OK
N+3.45	11	COMDERUMB1 MIN	-0,0013	-0,0006	0,00143	0,04	OK
N+3.45	11	COMDERUMB2 MAX	0,0014	0,001	0,00172	0,05	OK
N+3.45	11	COMDERUMB2 MIN	-0,0014	-0,001	0,00172	0,05	OK
BASE	11	COMDERUMB1 MAX	0	0	—	—	—
BASE	11	COMDERUMB1 MIN	0	0	—	—	—
BASE	11	COMDERUMB2 MAX	0	0	—	—	—
BASE	11	COMDERUMB2 MIN	0	0	—	—	—
N+3.45	12	COMDERUMB1 MAX	0,0013	0,0005	0,00139	0,04	OK
N+3.45	12	COMDERUMB1 MIN	-0,0013	-0,0005	0,00139	0,04	OK
N+3.45	12	COMDERUMB2 MAX	0,0014	0,0009	0,00166	0,05	OK
N+3.45	12	COMDERUMB2 MIN	-0,0014	-0,0009	0,00166	0,05	OK
BASE	12	COMDERUMB1 MAX	0	0	—	—	—
BASE	12	COMDERUMB1 MIN	0	0	—	—	—
BASE	12	COMDERUMB2 MAX	0	0	—	—	—
BASE	12	COMDERUMB2 MIN	0	0	—	—	—
N+3.45	13	COMDERUMB1 MAX	0,0013	0,0008	0,00153	0,04	OK

CÁLCULO DE DERIVAS MÁXIMAS (ESPECTRO DE UMBRAL DE DAÑO)

ALTURA DE N+[illegible]	0,59	m
ALTURA DE N+[illegible]	1,39	m
ALTURA DE N+[illegible]	0,50	m
ALTURA DE N+[illegible]	3,50	m
ALTURA DE BASE	0,00	m
ALTURA DE	0,00	m

Deriva Máxima Permitida 0,40 %

Nivel	Punto	COMBINACIÓN DE CARGA	DESPLAZAMIENTOS FUERZA SÍSMICA		Deriva Δ	Deriva Δ	Observación
			Desplazamiento X	Desplazamiento Y	m	%	
N+3.45	13	COMDERUMB1 MIN	-0,0013	-0,0008	0,00153	0,04	OK
N+3.45	13	COMDERUMB2 MAX	0,0014	0,0011	0,00178	0,05	OK
N+3.45	13	COMDERUMB2 MIN	-0,0014	-0,0011	0,00178	0,05	OK
BASE	13	COMDERUMB1 MAX	0	0	---	---	---
BASE	13	COMDERUMB1 MIN	0	0	---	---	---
BASE	13	COMDERUMB2 MAX	0	0	---	---	---
BASE	13	COMDERUMB2 MIN	0	0	---	---	---
N+3.45	14	COMDERUMB1 MAX	0,0013	0,0012	0,00177	0,05	OK
N+3.45	14	COMDERUMB1 MIN	-0,0013	-0,0012	0,00177	0,05	OK
N+3.45	14	COMDERUMB2 MAX	0,0014	0,0015	0,00205	0,06	OK
N+3.45	14	COMDERUMB2 MIN	-0,0014	-0,0015	0,00205	0,06	OK
BASE	14	COMDERUMB1 MAX	0	0	---	---	---
BASE	14	COMDERUMB1 MIN	0	0	---	---	---
BASE	14	COMDERUMB2 MAX	0	0	---	---	---
BASE	14	COMDERUMB2 MIN	0	0	---	---	---

7.2.6 VERIFICACION DE IRREGULARIDAD TORSIONAL

VERIFICACIÓN IRREGULARIDAD TORSIONAL

Story	Point	Load	UX	UY	UZ	Δ_1	*Irregularidad Torsional* 1.2*(Δ_1+Δ_2)/2	*Irregularidad Torsional Extrema* 1.4*(Δ_1+Δ_2)/2	I.T.Extrema≥Δ1 >I.T.?	Δ1>I.T.Extrema?
			m	m	m	m				
N+3.45	4	COMDER1 MAX	0,0069	0,0047	0	0,0083	0,0092	0,0108	NO	NO
N+3.45	4	COMDER1 MIN	-0,0069	-0,0047	0	0,0083	0,0092	0,0108	NO	NO
N+3.45	4	COMDER2 MAX	0,0042	0,006	0	0,0073	0,0086	0,0100	NO	NO
N+3.45	4	COMDER2 MIN	-0,0042	-0,006	0	0,0073	0,0086	0,0100	NO	NO
BASE	4	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	4	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	4	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	4	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

Story	Point	Load	UX	UY	UZ	Δ_1	*Irregularidad Torsional* 1.2*(Δ_1+Δ_2)/2	*Irregularidad Torsional Extrema* 1.4*(Δ_1+Δ_2)/2	I.T.Extrema≥Δ1 >I.T.?	Δ1>I.T.Extrema?
			m	m	m	m				
N+3.45	9	COMDER1 MAX	0,0052	0,0047	0	0,0070	0,0084	0,0098	NO	NO
N+3.45	9	COMDER1 MIN	-0,0052	-0,0047	0	0,0070	0,0084	0,0098	NO	NO
N+3.45	9	COMDER2 MAX	0,0035	0,006	0	0,0069	0,0091	0,0107	NO	NO
N+3.45	9	COMDER2 MIN	-0,0035	-0,006	0	0,0069	0,0091	0,0107	NO	NO
BASE	9	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	9	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	9	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	9	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

Story	Point	Load	UX	UY	UZ	Δ_1	*Irregularidad Torsional* 1.2*(Δ_1+Δ_2)/2	*Irregularidad Torsional Extrema* 1.4*(Δ_1+Δ_2)/2	I.T.Extrema≥Δ1 >I.T.?	Δ1>I.T.Extrema?
			m	m	m	m				
N+3.45	14	COMDER1 MAX	0,0052	0,0047	0	0,0070	0,0078	0,0091	NO	NO
N+3.45	14	COMDER1 MIN	-0,0052	-0,0047	0	0,0070	0,0078	0,0091	NO	NO
N+3.45	14	COMDER2 MAX	0,0057	0,006	0	0,0083	0,0092	0,0107	NO	NO
N+3.45	14	COMDER2 MIN	-0,0057	-0,006	0	0,0083	0,0092	0,0107	NO	NO
BASE	14	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	14	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	14	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	14	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

Story	Point	Load	UX	UY	UZ	Δ_1	*Irregularidad Torsional* $1.2*(\Delta_1+\Delta_2)/2$	*Irregularidad Torsional Extrema* $1.4*(\Delta_1+\Delta_2)/2$	I.T.Extrema≥Δ1 >I.T.?	Δ1>I.T.Extrema?
			m	m	m	m				
N+3.45	13	COMDER1 MAX	0,0052	0,003	0	0,0060	0,0070	0,0081	NO	NO
N+3.45	13	COMDER1 MIN	-0,0052	-0,003	0	0,0060	0,0070	0,0081	NO	NO
N+3.45	13	COMDER2 MAX	0,0057	0,0042	0	0,0071	0,0082	0,0096	NO	NO
N+3.45	13	COMDER2 MIN	-0,0057	-0,0042	0	0,0071	0,0082	0,0096	NO	NO
BASE	13	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	13	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	13	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	13	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

Story	Point	Load	UX	UY	UZ	Δ_1	*Irregularidad Torsional* $1.2*(\Delta_1+\Delta_2)/2$	*Irregularidad Torsional Extrema* $1.4*(\Delta_1+\Delta_2)/2$	I.T.Extrema≥Δ1 >I.T.?	Δ1>I.T.Extrema?
			m	m	m	m				
N+3.45	12	COMDER1 MAX	0,0052	0,0021	0	0,0056	0,0068	0,0080	NO	NO
N+3.45	12	COMDER1 MIN	-0,0052	-0,0021	0	0,0056	0,0068	0,0080	NO	NO
N+3.45	12	COMDER2 MAX	0,0057	0,0034	0	0,0066	0,0082	0,0096	NO	NO
N+3.45	12	COMDER2 MIN	-0,0057	-0,0034	0	0,0066	0,0082	0,0096	NO	NO
BASE	12	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	12	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	12	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	12	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

Story	Point	Load	UX	UY	UZ	Δ_1	*Irregularidad Torsional* $1.2*(\Delta_1+\Delta_2)/2$	*Irregularidad Torsional Extrema* $1.4*(\Delta_1+\Delta_2)/2$	I.T.Extrema≥Δ1 >I.T.?	Δ1>I.T.Extrema?
			m	m	m	m				
N+3.45	11	COMDER1 MAX	0,0052	0,0025	0	0,0058	0,0069	0,0081	NO	NO
N+3.45	11	COMDER1 MIN	-0,0052	-0,0025	0	0,0058	0,0069	0,0081	NO	NO
N+3.45	11	COMDER2 MAX	0,0057	0,0041	0	0,0070	0,0074	0,0087	NO	NO
N+3.45	11	COMDER2 MIN	-0,0057	-0,0041	0	0,0070	0,0074	0,0087	NO	NO
BASE	11	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	11	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	11	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	11	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

Story	Point	Load	UX	UY	UZ	Δ_1	Irregularidad Torsional $1.2*(\Delta_1+\Delta_2)/2$	Irregularidad Torsional Extrema $1.4*(\Delta_1+\Delta_2)/2$	I.T.Extrema≥Δ1 >I.T.?	Δ1>I.T.Extrema?
			m	m	m	m				
N+3.45	6	COMDER1 MAX	0,0052	0,0025	0	0,0058	0,0079	0,0092	NO	NO
N+3.45	6	COMDER1 MIN	-0,0052	-0,0025	0	0,0058	0,0079	0,0092	NO	NO
N+3.45	6	COMDER2 MAX	0,0035	0,0041	0	0,0054	0,0068	0,0079	NO	NO
N+3.45	6	COMDER2 MIN	-0,0035	-0,0041	0	0,0054	0,0068	0,0079	NO	NO
BASE	6	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	6	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	6	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	6	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

Story	Point	Load	UX	UY	UZ	Δ_1	Irregularidad Torsional $1.2*(\Delta_1+\Delta_2)/2$	Irregularidad Torsional Extrema $1.4*(\Delta_1+\Delta_2)/2$	I.T.Extrema≥Δ1 >I.T.?	Δ1>I.T.Extrema?
			m	m	m	m				
N+3.45	1	COMDER1 MAX	0,0069	0,0025	0	0,0073	0,0087	0,0102	NO	NO
N+3.45	1	COMDER1 MIN	-0,0069	-0,0025	0	0,0073	0,0087	0,0102	NO	NO
N+3.45	1	COMDER2 MAX	0,0042	0,0041	0	0,0059	0,0068	0,0079	NO	NO
N+3.45	1	COMDER2 MIN	-0,0042	-0,0041	0	0,0059	0,0068	0,0079	NO	NO
BASE	1	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	1	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	1	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	1	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

Story	Point	Load	UX	UY	UZ	Δ_1	Irregularidad Torsional $1.2*(\Delta_1+\Delta_2)/2$	Irregularidad Torsional Extrema $1.4*(\Delta_1+\Delta_2)/2$	I.T.Extrema≥Δ1 >I.T.?	Δ1>I.T.Extrema?
			m	m	m	m				
N+3.45	2	COMDER1 MAX	0,0069	0,0021	0	0,0072	0,0088	0,0103	NO	NO
N+3.45	2	COMDER1 MIN	-0,0069	-0,0021	0	0,0072	0,0088	0,0103	NO	NO
N+3.45	2	COMDER2 MAX	0,0042	0,0034	0	0,0054	0,0068	0,0079	NO	NO
N+3.45	2	COMDER2 MIN	-0,0042	-0,0034	0	0,0054	0,0068	0,0079	NO	NO
BASE	2	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	2	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	2	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	2	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

Story	Point	Load	UX	UY	UZ	Δ_1	Irregularidad Torsional $1.2*(\Delta_1+\Delta_2)/2$	Irregularidad Torsional Extrema $1.4*(\Delta_1+\Delta_2)/2$	I.T.Extrema≥Δ1 >I.T.?	Δ1>I.T.Extrema?
			m	m	m	m				
N+3.45	3	COMDER1 MAX	0,0069	0,003	0	0,0075	0,0095	0,0111	NO	NO
N+3.45	3	COMDER1 MIN	-0,0069	-0,003	0	0,0075	0,0095	0,0111	NO	NO
N+3.45	3	COMDER2 MAX	0,0042	0,0042	0	0,0059	0,0080	0,0093	NO	NO
N+3.45	3	COMDER2 MIN	-0,0042	-0,0042	0	0,0059	0,0080	0,0093	NO	NO
BASE	3	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	3	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	3	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	3	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

7.3 DISEÑO DE CIMENTACIÓN

7.3.1 ELECCIÓN DE CARGAS PARA DISEÑO DE CIMENTACIÓN

DISEÑO ESTRUCTURAL DE ZAPATAS CONCÉNTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA

BLOQUE B

CARGA ADMISIBLE	12.00	Ton/m^2	VERTICALES
CARGA ADMISIBLE S	15.96	Ton/m^2	SISMO

ZAPATA	B_X (m)	L_Y (m)	H (m)	Q_{MAX} (Ton/m^2) CARGA VERTICAL	Q_{MAX} (Ton/m^2) SISMO	Q_{MIN} (Ton/m^2)	CHEQUEO	TIPO DE ZAPATA	REFUERZO EN X	REFUERZO EN Y
B-2	1.40	1.40	0.30	10.86	11.43	0.76	O.K.		6 VARILLAS No. 4 L = 1.3 m. @ 26 cm.	6 VARILLAS No. 4 L = 1.3 m. @ 26 cm.
B-3	1.40	1.40	0.30	10.78	10.99	0.73	O.K.		5 VARILLAS No. 4 L = 1.3 m. @ 32.5 cm.	5 VARILLAS No. 4 L = 1.3 m. @ 32.5 cm.
C-2	1.40	1.40	0.30	11.83	10.73	0.72	O.K.		5 VARILLAS No. 4 L = 1.3 m. @ 32.5 cm.	5 VARILLAS No. 4 L = 1.3 m. @ 32.5 cm.
C-3	1.40	1.40	0.30	11.79	9.85	1.02	O.K.		5 VARILLAS No. 4 L = 1.3 m. @ 32.5 cm.	5 VARILLAS No. 4 L = 1.3 m. @ 32.5 cm.
C-4	1.50	1.50	0.30	11.71	11.07	0.50	O.K.		7 VARILLAS No. 4 L = 1.4 m. @ 23.33 cm.	7 VARILLAS No. 4 L = 1.4 m. @ 23.33 cm.
C-1	1.55	1.55	0.30	8.75	7.97	0.31	O.K.		6 VARILLAS No. 4 L = 1.45 m. @ 29 cm.	6 VARILLAS No. 4 L = 1.45 m. @ 29 cm.
A-2	1.65	1.65	0.30	4.23	9.23	0.23	O.K.		8 VARILLAS No. 4 L = 1.55 m. @ 22.14 cm.	8 VARILLAS No. 4 L = 1.55 m. @ 22.14 cm.
A-3	1.65	1.65	0.30	4.10	8.87	0.33	O.K.		7 VARILLAS No. 4 L = 1.55 m. @ 25.83 cm.	7 VARILLAS No. 4 L = 1.55 m. @ 25.83 cm.
B-1	1.65	1.65	0.30	7.12	9.26	0.37	O.K.		8 VARILLAS No. 4 L = 1.55 m. @ 22.14 cm.	8 VARILLAS No. 4 L = 1.55 m. @ 22.14 cm.
B-4	1.65	1.65	0.30	9.35	11.88	0.55	O.K.		10 VARILLAS No. 4 L = 1.55 m. @ 17.22 cm.	10 VARILLAS No. 4 L = 1.55 m. @ 17.22 cm.
A-1	1.85	1.85	0.30	3.79	7.99	0.14	O.K.		10 VARILLAS No. 4 L = 1.75 m. @ 19.44 cm.	10 VARILLAS No. 4 L = 1.75 m. @ 19.44 cm.
A-4	1.85	1.85	0.30	4.61	8.88	0.49	O.K.		11 VARILLAS No. 4 L = 1.75 m. @ 17.5 cm.	11 VARILLAS No. 4 L = 1.75 m. @ 17.5 cm.

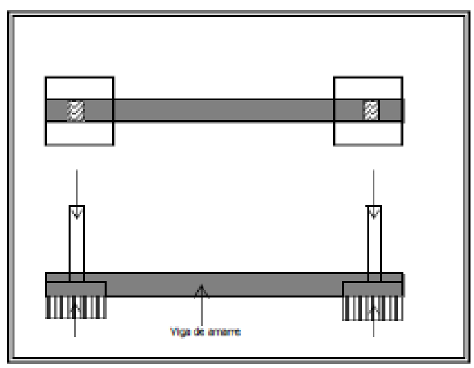
7.3.2 DISEÑOVIGASDEAMARRE

PROYECTO: I. E.ALFREDO BONILLA SEDE No. 2 MARÍA INMACULADA

VIGA DE AMARRE TIPO

f'c = **21,1** MPa
fy = **420** MPa

b = **0,30** m
h = **0,50** m



Pmáx = 103,32 kN

De acuerdo a el numeral A.3.6.4.2 de la NSR-10 tenemos:

Aa = *0,25*
Paxial = 0.25*Aa*Pmáx
Paxial = *6,458* kN

DISEÑO A TENSIÓN

As = 1.7*6.4575/(0.90*420)
As = **0,29** cm^2

DISEÑO A COMPRESIÓN

P com = 1.7*6.4575
P com = *11,0* kN

Para esta carga la sección requiere cuantía mínima:

As = 0.00333*0.3*0.45
As = **4,50** cm^2

Se suministra un refuerzo constituido por 3#5 arriba y abajo (como refuerzo mínimo).

7.3.3 DISEÑO DE ZAPATAS

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE B

ZAPATA CONCENTRICA No. C4

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	= 2.40	Ton/m³		ϕ =	0.85	-
Peso unitario del suelo (γ_s)	= 1.80	Ton/m³		$\phi v_c = \phi \cdot 0.27 \cdot (2+4/\beta_c) \cdot f'_c{}^{0.5}$ =	15.52	Kg/cm²
Capacidad admisible del suelo (q_{adm})	= 12.00	Ton/m²		α_s =	20.00	-
Profundidad de desplante (D)	= 1.50	m		d =	22.50	cm
Area columnas (A_c)	= 0.24	m²		b_o =	290.00	cm
b_{colum} (Sentido X)	= 40.00	cm		$\phi v_c = \phi \cdot 0.27 \cdot (2+\alpha_s \cdot d/b_o) \cdot f'_c{}^{0.5}$ =	11.81	Kg/cm²
t_{colum} (Sentido Y)	= 60.00	cm		$\phi v_c = \phi \cdot 1.1 \cdot f'_c{}^{0.5}$ =	13.55	Kg/cm²
β_c	= 1.50	-				
f_y	= 4,200.00	Kg/cm²		ϕv_c (como losa) =	11.81	Kg/cm²
f'_c	= 210.00	Kg/cm²		$\phi v_c = \phi \cdot 0.53 \cdot f'_c{}^{0.5}$ (como viga) =	6.53	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		COMBINACIONES DE CARGA																
Ancho zapata en el sentido X (B_x)	m	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55
Largo zapata en el sentido Y (L_y)	m	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55
B_{zap} / L_{zap}	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d_b columna	cm	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
d_b zapata	cm	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
l_d	cm	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
h zapata req.	m	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
h_z	m	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**
d zapata = (h_z - 0.075)	m	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Area zapata (A)	m²	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40
Peso zapata (W_z)	Ton	1.73	1.73	1.73	1.73	1.73	1.73	1.73	1.73	1.73	1.73	1.73	1.73	1.73	1.73	1.73	1.73	1.73
Peso suelo (W_s)	Ton	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67
Pz	Ton	5.18	5.26	5.23	4.84	5.45	5.45	5.35	5.35	5.45	5.45	5.38	5.38	2.36	2.36	3.29	3.29	0.00
Peso total (Wt = Pz+Wz+Ws)	Ton	11.58	11.66	11.63	11.24	11.85	11.85	11.75	11.75	11.85	11.85	11.78	11.78	8.76	8.76	9.69	9.69	6.40
Mx	Ton-m	-0.99	-1.01	-1.90	-2.67	0.13	0.13	1.26	1.26	-0.15	-0.15	0.70	0.70	0.53	0.53	1.65	1.65	0.00
Fy	Ton	0.88	0.89	0.89	1.19	1.20	1.20	1.72	1.72	1.21	1.21	1.53	1.53	0.95	0.95	1.37	1.37	0.00
My	Ton-m	-0.15	-0.15	-0.15	-0.16	1.40	1.40	0.86	0.86	1.00	1.00	0.82	0.82	1.45	1.45	0.82	0.82	0.00
Fx	Ton	0.06	0.06	0.06	0.05	0.78	0.78	0.52	0.52	0.60	0.60	0.42	0.42	0.75	0.75	0.51	0.51	0.00
Mfx = Mx+Fy*hz	Ton-m	1.25	1.28	-1.27	2.43	0.26	0.26	0.74	0.74	0.52	0.52	0.24	0.24	0.24	0.24	1.24	1.24	0.00
Mfy = My+Fx*hz	Ton-m	0.13	0.13	0.13	0.15	1.63	1.63	1.02	1.02	1.20	1.20	0.75	0.75	1.68	1.68	1.07	1.07	0.00
e_x = Mfy/Wt	m	0.01	0.01	0.01	0.01	0.14	0.14	0.09	0.09	0.10	0.10	0.06	0.06	0.17	0.17	0.11	0.11	0.00
e_y = Mfx/Wt	m	0.11	0.11	0.11	0.22	0.02	0.02	0.06	0.06	0.04	0.04	0.02	0.02	0.02	0.02	0.13	0.13	0.00
$6e_x/B_x$	-	0.04	0.04	0.04	0.05	0.53	0.53	0.34	0.34	0.39	0.39	0.24	0.24	0.66	0.66	0.43	0.43	0.00
$6e_y/L_y$	-	0.42	0.43	0.42	0.85	0.08	0.08	0.24	0.24	0.17	0.17	0.08	0.08	0.10	0.10	0.50	0.50	0.00
q_{max}	Ton/m²	**7.03**	**7.12**	**7.09**	**8.75**	**7.87**	**7.87**	**7.73**	**7.73**	**7.71**	**7.71**	**6.49**	**6.49**	**7.17**	**7.17**	**7.78**	**7.78**	**2.66**
q_{min}	Ton/m²	**2.60**	**2.59**	**2.59**	**0.45**	**1.09**	**1.09**	**2.05**	**2.05**	**2.15**	**2.15**	**3.32**	**3.32**	**0.90**	**0.90**	**0.01**	**0.01**	**2.66**
CHEQUEO CAPACIDAD ADMISIBLE	-	O.K.																
DISEÑO ZAPATA - CARGAS MAYORADAS																		
P_u	Ton	7.23	8.35	8.70	8.70	6.56	6.56	5.05	5.05	4.92	4.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peso total mayorado (W_u)	Ton	16.19	13.07	13.42	13.42	13.29	13.29	11.78	11.78	11.64	11.64	8.72	8.72	8.72	8.72	8.72	8.72	8.72
Mx_u	Ton-m	-1.28	-1.22	0.36	0.36	2.00	2.00	0.71	0.71	2.22	2.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fy_u	Ton	1.23	1.08	1.68	1.68	2.28	2.28	1.40	1.40	2.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My_u	Ton-m	-0.20	-0.17	2.02	2.02	1.27	1.27	2.07	2.07	1.21	1.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fx_u	Ton	0.09	0.07	1.10	1.10	0.75	0.75	1.08	1.08	0.73	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mf_{xu}	Ton-m	1.75	1.55	0.89	0.89	2.90	2.90	1.13	1.13	2.90	2.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mf_{yu}	Ton-m	0.23	0.20	2.35	2.35	1.49	1.49	2.39	2.39	1.53	1.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{xu}	m	0.01	0.02	0.18	0.18	0.11	0.11	0.20	0.20	0.13	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{yu}	m	0.11	0.12	0.07	0.07	0.20	0.20	0.10	0.10	0.25	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{xu}/B_x$	-	0.05	0.08	0.68	0.68	0.43	0.43	0.79	0.79	0.51	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{yu}/L_y$	-	0.42	0.48	0.26	0.26	0.78	0.78	0.37	0.37	0.97	0.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00
q_{umax}	Ton/m²	9.93	8.28	10.82	10.82	12.35	12.35	10.58	10.58	12.01	12.01	2.80	2.80	2.80	2.80	2.80	2.80	2.80
q_{umin}	Ton/m²	3.55	2.63	0.35	0.35	-1.19	-1.19	-0.78	-0.78	-2.32	-2.32	2.80	2.80	2.80	2.80	2.80	2.80	2.80
ACCION COMO VIGA																		
DIRECCION X																		
V_u	Ton	5.39	4.47	5.87	5.87	6.65	6.65	5.74	5.74	6.51	6.51	1.52	1.52	1.52	1.52	1.52	1.52	1.52
v_u	Kg/cm²	1.54	1.28	1.68	1.68	1.91	1.91	1.65	1.65	1.87	1.87	0.44	0.44	0.44	0.44	0.44	0.44	0.44
$v_u \le \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN X - v_{umax}	Kg/cm²	1.91																
DIRECCION Y																		
V_u	Ton	3.85	3.20	4.75	4.75	4.75	4.75	4.10	4.10	4.65	4.65	1.08	1.08	1.08	1.08	1.08	1.08	1.08
v_u	Kg/cm²	1.10	0.92	1.36	1.36	1.36	1.36	1.18	1.18	1.33	1.33	0.31	0.31	0.31	0.31	0.31	0.31	0.31
$v_u \le \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN Y - v_{umax}	Kg/cm²	1.36																
ACCION COMO LOSA																		
b_o	cm	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00
V_u	Ton	18.73	15.58	20.42	20.42	23.12	23.12	19.97	19.97	22.66	22.66	5.28	5.28	5.28	5.28	5.28	5.28	5.28
v_u	Kg/cm²	2.87	2.38	3.13	3.13	3.54	3.54	3.06	3.06	3.47	3.47	0.81	0.81	0.81	0.81	0.81	0.81	0.81
$v_u \le \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO LOSA - v_{umax}	Kg/cm²	3.54																
DISEÑO A FLEXION EN DOS DIRECCIONES																		
DIRECCION X																		
M_{ux}	Ton-cm	**284.30**	**422.62**	**554.73**	**554.73**	**627.08**	**627.08**	**542.38**	**542.38**	**615.30**	**615.30**	**143.38**	**143.38**	**143.38**	**143.38**	**143.38**	**143.38**	**143.38**
K_u	Ton/cm²	0.00324	0.00539	0.00707	0.00707	0.00800	0.00800	0.00691	0.00691	0.00784	0.00784	0.00183	0.00183	0.00183	0.00183	0.00183	0.00183	0.00183
ρ_x > 0.0018	-	0.00097	0.00145	0.00190	0.00190	0.00218	0.00218	0.00188	0.00188	0.00213	0.00213	0.00049	0.00049	0.00049	0.00049	0.00049	0.00049	0.00049
A_{sx}	cm²	6.28	6.28	6.69	6.69	7.60	7.60	6.54	6.54	7.44	7.44	6.28	6.28	6.28	6.28	6.28	6.28	6.28
Longitud de varilla	cm	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00
DIRECCION Y																		
M_{uy}	Ton-cm	**247.15**	**280.45**	**376.56**	**376.56**	**425.45**	**425.45**	**370.05**	**370.05**	**419.95**	**419.95**	**97.03**	**97.03**	**97.03**	**97.03**	**97.03**	**97.03**	**97.03**
K_u	Ton/cm²	0.00440	0.00366	0.00480	0.00480	0.00546	0.00546	0.00473	0.00473	0.00535	0.00535	0.00125	0.00125	0.00125	0.00125	0.00125	0.00125	0.00125
ρ_y > 0.0018	-	0.00126	0.00104	0.00137	0.00137	0.00156	0.00156	0.00134	0.00134	0.00153	0.00153	0.00035	0.00035	0.00035	0.00035	0.00035	0.00035	0.00035
A_{sy}	cm²	6.28	6.28	6.69	6.69	7.60	7.60	6.54	6.54	7.44	7.44	6.28	6.28	6.28	6.28	6.28	6.28	6.28
Longitud de varilla	cm	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00
REFUERZO REQUERIDO																		
A_{sx} Máximo	cm²	7.60																
A_{sy} Máximo	cm²	7.60																
EN SENTIDO X USAR	-	5 VARILLAS No. 4 L = 1.45 m. @ 29 cm.																
EN SENTIDO Y USAR	-	5 VARILLAS No. 4 L = 1.45 m. @ 29 cm.																

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE B

ZAPATA CONCENTRICA No. C2

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	= 2.40	Ton/m³	ϕ =	0.85	-
Peso unitario del suelo (γ_s)	= 1.80	Ton/m³	v_c = [illegible] =	15.52	Kg/cm²
Capacidad admisible del suelo (q_{adm})	= 12.00	Ton/m²	α_s =	20.00	-
Profundidad de desplante (D)	= 1.50	m	d =	22.50	cm
Área columnas (A_c)	= 0.24	m²	b_0 =	260.00	cm
$b_{columna}$ (Sentido X)	= 60.00	cm	v_c = [illegible] =	11.81	Kg/cm²
$h_{columna}$ (Sentido Y)	= 60.00	cm	v_c = [illegible] =	13.55	Kg/cm²
β_c	= 1.50	-			
f_y	= 4,200.00	Kg/cm²	v_c (como losa) =	11.81	Kg/cm²
f'_c	= 210.00	Kg/cm²	v_c = [illegible] (como viga) =	6.53	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Ancho zapata en el sentido X (B_x)	m	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40
Largo zapata en el sentido Y (L_y)	m	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40
[illegible]	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d_b columna	cm	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
d_b zapata	cm	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
l_d = [illegible]	cm	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
h zapata req. [illegible]	m	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58
h_z	m	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**
d zapata = (h_z - 0.075)	m	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Área zapata (A)	m²	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
Peso zapata (W_z = [illegible])	Ton	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41
Peso suelo (W_s = [illegible])	Ton	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72
Fz	Ton	6.84	7.02	6.98	5.80	6.97	6.97	7.03	7.03	7.08	7.08	7.12	7.12	4.24	4.24	4.29	4.29	0.00
Peso total (W_t = Fz+W_z+W_s)	Ton	11.97	12.15	12.11	10.93	12.10	12.10	12.16	12.16	12.20	12.20	12.25	12.25	9.38	9.38	9.42	9.42	5.13
Mx	Ton-m	-0.95	-0.95	-0.98	-1.09	-0.36	-0.36	0.61	0.61	-0.52	-0.52	0.20	0.20	0.02	0.02	0.89	0.89	0.00
Fy	Ton	0.86	0.88	0.89	1.04	1.08	1.08	1.44	1.44	1.05	1.05	1.32	1.32	0.74	0.74	1.09	1.09	0.00
My	Ton-m	-0.55	-0.55	-0.55	-0.57	1.22	1.22	0.60	0.60	0.79	0.79	0.32	0.32	1.44	1.44	0.82	0.82	0.00
Fx	Ton	-0.29	-0.29	-0.29	-0.30	0.82	0.82	0.30	0.30	0.40	0.40	0.16	0.16	0.74	0.74	0.42	0.42	0.00
Mx = Mx+Fy*h_z	Ton-m	1.21	1.26	1.24	2.20	0.66	0.66	0.18	0.18	0.84	0.84	0.19	0.19	0.20	0.20	0.86	0.86	0.00
My = My+Fx*h_z	Ton-m	0.84	0.84	0.84	0.86	1.40	1.40	0.89	0.89	0.91	0.91	0.37	0.37	1.66	1.66	0.95	0.95	0.00
e_x = My/W_t	m	0.05	0.05	0.05	0.06	0.12	0.12	0.08	0.08	0.07	0.07	0.03	0.03	0.18	0.18	0.10	0.12	0.00
e_y = Mx/W_t	m	0.10	0.10	0.10	0.20	0.06	0.06	0.01	0.01	0.07	0.07	0.03	0.03	0.02	0.02	0.07	0.07	0.00
6e_x/B_x	-	0.20	0.22	0.22	0.26	0.50	0.50	0.24	0.24	0.32	0.32	0.13	0.13	0.78	0.78	0.42	0.42	0.00
6e_y/L_y	-	0.43	0.44	0.44	0.86	0.24	0.24	0.06	0.06	0.29	0.29	0.07	0.07	0.09	0.09	0.30	0.30	0.00
q_{max} = [illegible]	Ton/m²	**10.16**	**10.33**	**10.28**	**11.83**	**10.73**	**10.73**	**8.10**	**8.10**	**10.06**	**10.06**	**7.48**	**7.48**	**8.84**	**8.84**	**8.33**	**8.33**	**2.62**
q_{min} = [illegible]	Ton/m²	**2.07**	**2.07**	**2.07**	**-0.87**	**1.80**	**1.80**	**4.31**	**4.31**	**2.41**	**2.41**	**5.03**	**5.03**	**0.73**	**0.73**	**1.29**	**1.29**	**2.62**
CHEQUEO CAPACIDAD ADMISIBLE	-	O.K.																

DISEÑO ZAPATA - CARGAS MAYORADAS

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Fz_u	Ton	8.58	8.50	8.58	8.58	8.66	8.66	6.35	6.35	6.43	6.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peso total mayorado (W_{tu} = [illegible])	Ton	15.76	13.86	13.96	13.96	14.04	14.04	11.73	11.73	11.81	11.81	5.38	5.38	5.38	5.38	5.38	5.38	5.38
Mx_u	Ton-m	-1.20	-1.19	-0.32	-0.32	1.05	1.05	-0.01	-0.01	1.37	1.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fy_u	Ton	1.20	1.07	1.37	1.37	1.88	1.88	1.09	1.09	1.60	1.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My_u	Ton-m	-0.77	-0.85	1.87	1.87	0.98	0.99	2.03	2.02	1.15	1.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fx_u	Ton	-0.41	-0.35	0.95	0.95	0.50	0.50	1.04	1.04	0.59	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mx_u = Mx_u+Fy_u*h_z	Ton-m	1.69	1.51	0.74	0.74	1.60	1.60	0.33	0.33	1.85	1.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My_u = My_u+Fx_u*h_z	Ton-m	0.89	0.77	2.15	2.15	1.13	1.13	2.34	2.34	1.33	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{xu} = My_u/W_{tu}	m	0.05	0.06	0.15	0.15	0.08	0.08	0.20	0.20	0.11	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{yu} = Mx_u/W_{tu}	m	0.10	0.11	0.05	0.05	0.12	0.12	0.03	0.03	0.16	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6e_{xu}/B_x	-	0.23	0.24	0.66	0.66	0.35	0.35	0.86	0.86	0.48	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6e_{yu}/L_y	-	0.45	0.47	0.23	0.23	0.49	0.49	0.12	0.12	0.67	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00
q_{maxu} = [illegible]	Ton/m²	14.21	13.07	13.44	13.44	13.16	13.16	11.84	11.84	12.97	12.97	2.75	2.75	2.75	2.75	2.75	2.75	2.75
q_{minu} = [illegible]	Ton/m²	2.90	3.09	0.81	0.81	1.15	1.15	0.13	0.13	-0.93	-0.93	2.75	2.75	2.75	2.75	2.75	2.75	2.75

ACCION COMO VIGA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
V_u = [illegible]	Ton	5.47	4.85	5.17	5.17	5.07	5.07	4.59	4.59	4.99	4.99	1.08	1.08	1.08	1.08	1.08	1.08	1.08
v_u = [illegible]	Kg/cm²	1.74	1.46	1.64	1.64	1.61	1.61	1.45	1.45	1.58	1.58	0.34	0.34	0.34	0.34	0.34	0.34	0.34
v_u ≤ ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN X - v_{max}	Kg/cm²	**1.74**																
DIRECCION Y																		
V_u = [illegible]	Ton	3.48	2.96	3.29	3.29	3.23	3.23	2.90	2.90	3.18	3.18	0.67	0.67	0.67	0.67	0.67	0.67	0.67
v_u = [illegible]	Kg/cm²	1.10	0.94	1.05	1.05	1.02	1.02	0.92	0.92	1.01	1.01	0.21	0.21	0.21	0.21	0.21	0.21	0.21
v_u ≤ ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN Y - v_{max}	Kg/cm²	**1.10**																

ACCION COMO LOSA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
b_0	cm	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00	260.00
V_u = [illegible]	Ton	20.50	17.44	19.41	19.41	19.03	19.03	17.10	17.10	18.73	18.73	3.97	3.97	3.97	3.97	3.97	3.97	3.97
v_u = [illegible]	Kg/cm²	3.14	2.67	2.98	2.98	2.92	2.92	2.62	2.62	2.87	2.87	0.61	0.61	0.61	0.61	0.61	0.61	0.61
v_u ≤ ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO LOSA - v_{max}	Kg/cm²	**3.14**																

DISEÑO A FLEXION EN DOS DIRECCIONES

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
M_{ux} = [illegible]	Ton-cm	**348.80**	**422.80**	**470.40**	**470.40**	**481.17**	**481.17**	**414.34**	**414.34**	**483.86**	**483.86**	**86.12**	**86.12**	**86.12**	**86.12**	**86.12**	**86.12**	**86.12**
K_u = [illegible]	Ton/cm²	0.00351	0.00596	0.00664	0.00664	0.00651	0.00651	0.00585	0.00585	0.00640	0.00640	0.00136	0.00136	0.00136	0.00136	0.00136	0.00136	0.00136
ρ_x = [illegible] ≥ 0.0018	-	0.00094	0.00161	0.00180	0.00180	0.00176	0.00176	0.00158	0.00158	0.00173	0.00173	0.00036	0.00036	0.00036	0.00036	0.00036	0.00036	0.00036
A_{sx} = [illegible]	cm²	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67
Longitud de varilla = B_x - 10	cm	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00
DIRECCION Y																		
M_{uy} = [illegible]	Ton-cm	**318.21**	**273.48**	**301.06**	**301.06**	**295.10**	**295.10**	**265.10**	**265.10**	**290.47**	**290.47**	**81.82**	**81.82**	**81.82**	**81.82**	**81.82**	**81.82**	**81.82**
K_u = [illegible]	Ton/cm²	0.00449	0.00383	0.00425	0.00425	0.00416	0.00416	0.00374	0.00374	0.00410	0.00410	0.00087	0.00087	0.00087	0.00087	0.00087	0.00087	0.00087
ρ_y = [illegible] ≥ 0.0018	-	0.00126	0.00108	0.00121	0.00121	0.00118	0.00118	0.00106	0.00106	0.00116	0.00116	0.00024	0.00024	0.00024	0.00024	0.00024	0.00024	0.00024
A_{sy} = [illegible]	cm²	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67	5.67
Longitud de varilla = L_y - 10	cm	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	**5.67**
A_{sy} Máximo	cm²	**5.67**
EN SENTIDO X USAR	-	**5 VARILLAS No. 4 L = 1.3 m. @ 22.5 cm.**
EN SENTIDO Y USAR	-	**5 VARILLAS No. 4 L = 1.3 m. @ 22.5 cm.**

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE B

ZAPATA CONCENTRICA No. C3

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	= 2.40	Ton/m³		ϕ =	0.85	-
Peso unitario del suelo (γ_s)	= 1.80	Ton/m³	ϕv_c =		13.52	Kg/cm²
Capacidad admisible del suelo (q_{adm})	= 12.00	Ton/m³	α_s =		20.00	-
Profundidad de desplante (D)	= 1.50	m.	d =		22.50	cm.
Area columnas (A_c)	= 0.24	m²	b_o =		290.00	cm.
b_{colum} (Sentido X)	= 40.00	cm.	ϕv_c =		11.01	Kg/cm²
t_{colum} (Sentido Y)	= 60.00	cm.	ϕv_c =		13.55	Kg/cm²
β_c	= 1.50	-				
f_y	= 4,200.00	Kg/cm²	ϕv_c (como losa) =		11.01	Kg/cm²
f'_c	= 210.00	Kg/cm²	ϕv_c (como viga) =		6.52	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DISEÑO ZAPATA - CARGAS MAYORADAS

ACCION COMO VIGA

ACCION COMO LOSA

DISEÑO A FLEXION EN DOS DIRECCIONES

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	5.67
A_{sy} Máximo	cm²	5.67
EN SENTIDO X USAR	-	5 VARILLAS No. 4 L = 1.3 m. @ 33.5 cm.
EN SENTIDO Y USAR	-	5 VARILLAS No. 4 L = 1.3 m. @ 33.5 cm.

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE B

ZAPATA CONCENTRICA No. C4

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	=	2.40	Ton/m³	α =	3.85	-
Peso unitario del suelo (γ_s)	=	1.80	Ton/m³	[illegible] =	15.52	Kg/cm²
Capacidad admisible del suelo (q_{adm})	=	12.00	Ton/m²	[illegible] =	20.00	-
Profundidad de desplante (D)	=	1.50	m.	d =	22.50	cm.
Area columna (A_c)	=	0.24	m²	[illegible] =	290.00	cm.
[illegible] (Sentido X)	=	40.00	cm.	[illegible] =	11.01	Kg/cm²
[illegible] (Sentido Y)	=	60.00	cm.	[illegible] =	13.55	Kg/cm²
[illegible]	=	1.50	-			
[illegible]	=	4,200.00	Kg/cm²	[illegible] (como losa) =	11.01	Kg/cm²
[illegible]	=	210.00	Kg/cm²	[illegible] (como viga) =	9.52	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Ancho zapata en el sentido X (B_x)	m.	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Largo zapata en el sentido Y (L_y)	m.	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
[illegible]	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
[illegible] columna	cm.	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
[illegible] zapata	cm.	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
[illegible]	cm.	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
[illegible] zapata req. H = [illegible]	m.	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56

CHEQUEO CAPACIDAD ADMISIBLE: O.K.

DISEÑO ZAPATA - CARGAS MAYORADAS

ACCION COMO VIGA

CHEQUEO ACCION COMO VIGA EN X: 2.22 Kg/cm²

CHEQUEO ACCION COMO VIGA EN Y: 1.64 Kg/cm²

ACCION COMO LOSA

CHEQUEO ACCION COMO LOSA: 4.08 Kg/cm²

DISEÑO A FLEXION EN DOS DIRECCIONES

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	8.40
A_{sy} Máximo	cm²	8.40
EN SENTIDO X USAR	-	7 VARILLAS No. 4 L = 1.4 m. @ 23.30 cm.
EN SENTIDO Y USAR	-	7 VARILLAS No. 4 L = 1.4 m. @ 23.30 cm.

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE B

ZAPATA CONCENTRICA No. B-1

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	=	2.40	Ton/m³	β =	0.85	-
Peso unitario del suelo (γ_s)	=	1.80	Ton/m³	$\phi v_c = \phi \cdot 0.27 \cdot (2+4/\beta_c) \cdot (f'_c)^{1/2}$ =	15.52	Kg/cm²
Capacidad admisible del suelo (q_{adm})	=	12.00	Ton/m²	α_s =	20.00	-
Profundidad de desplante (D)	=	1.50	m	c =	22.50	cm
Area columna (A_c)	=	0.24	m²	b_o =	280.00	cm
$b_{columna}$ (Sentido X)	=	40.00	cm	$\phi v_c = \phi \cdot 0.27 \cdot (2+\alpha_s d/b_o) \cdot (f'_c)^{1/2}$ =	11.81	Kg/cm²
$l_{columna}$ (Sentido Y)	=	60.00	cm	$\phi v_c = \phi \cdot 1.1 \cdot (f'_c)^{1/2}$ =	13.55	Kg/cm²
β_c	=	1.50	-			
f_y	=	4,200.00	Kg/cm²	ϕv_c (como losa) =	11.81	Kg/cm²
f'_c	=	210.00	Kg/cm²	$\phi v_c = \phi \cdot 0.53 \cdot (f'_c)^{1/2}$ (como viga) =	6.53	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		COMBINACIONES DE CARGA																
Ancho zapata en el sentido X (B_x)	m	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65
Largo zapata en el sentido Y (L_y)	m	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65
B_{req} / B_{real}	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d_b columna	cm	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
d_b zapata	cm	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
l_d	cm	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
h zapata req.	m	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
h	m	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**
d zapata = (h_z - 0.075)	m	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Area zapata (A)	m²	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72
Peso zapata (W_z)	Ton	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
Peso suelo (W_s)	Ton	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36
Fz	Ton	6.93	7.06	7.03	7.09	7.16	7.16	7.04	7.04	7.21	7.21	7.11	7.11	4.39	4.39	4.26	4.26	0.00
Peso total (Wt = Fz+Ws+Wz)	Ton	14.25	14.38	14.35	14.41	14.49	14.49	14.36	14.36	14.53	14.53	14.42	14.42	11.72	11.72	11.59	11.59	7.32
Mx	Ton-m	0.23	0.24	0.22	-1.15	1.52	1.52	2.62	2.62	1.27	1.27	2.20	2.20	1.42	1.43	2.72	2.72	0.00
Fy	Ton	-0.21	-0.22	-0.22	0.36	0.27	0.27	0.95	0.95	0.22	0.22	0.66	0.66	0.45	0.45	1.04	1.04	0.00
My	Ton-m	-0.13	-0.13	-0.13	-0.12	0.99	0.99	0.36	0.36	0.72	0.72	0.24	0.24	1.04	1.04	0.41	0.41	0.00
Fx	Ton	0.06	0.06	0.06	0.06	0.58	0.58	0.29	0.29	0.48	0.48	0.24	0.24	0.56	0.56	0.26	0.26	0.00
M'x = Mx+Fy*h	Ton-m	0.29	0.30	0.30	1.26	1.41	1.41	2.54	2.54	1.15	1.15	2.00	2.00	1.29	1.29	2.42	2.42	0.00
M'y = My+Fx*h	Ton-m	0.11	0.11	0.11	0.11	1.16	1.16	0.44	0.44	0.88	0.88	0.31	0.31	1.21	1.21	0.49	0.49	0.00
e_x = M'y/Wt	m	0.01	0.01	0.01	0.01	0.08	0.08	0.03	0.03	0.06	0.06	0.02	0.02	0.10	0.10	0.04	0.04	0.00
e_y = M'x/Wt	m	0.02	0.02	0.02	0.09	0.10	0.10	0.18	0.18	0.08	0.08	0.14	0.14	0.11	0.11	0.21	0.21	0.00
$6e_x/B_x$	-	0.03	0.03	0.03	0.03	0.29	0.29	0.11	0.11	0.21	0.21	0.08	0.08	0.38	0.38	0.15	0.15	0.00
$6e_y/L_y$	-	0.07	0.08	0.08	0.32	0.35	0.35	0.64	0.64	0.29	0.29	0.50	0.50	0.40	0.40	0.76	0.75	0.00
q_{max}	Ton/m²	**5.70**	**5.84**	**5.82**	**7.12**	**6.76**	**6.76**	**8.35**	**8.35**	**6.81**	**6.81**	**6.39**	**6.39**	**7.84**	**7.84**	**6.19**	**6.19**	**2.69**
q_{min}	Ton/m²	**4.80**	**4.73**	**4.72**	**3.45**	**1.89**	**1.89**	**1.29**	**1.29**	**2.86**	**2.86**	**2.21**	**2.21**	**0.95**	**0.95**	**0.37**	**0.37**	**2.69**
CHEQUEO CAPACIDAD ADMISIBLE	-	O.K.																

DISEÑO ZAPATA - CARGAS MAYORADAS

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Fz_u	Ton	9.70	6.53	8.79	8.79	8.60	8.60	8.57	8.57	6.39	6.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peso total mayorado (W_{tu})	Ton	19.95	18.22	18.48	18.48	18.29	18.29	14.26	14.26	14.08	14.08	7.69	7.69	7.69	7.69	7.69	7.69	7.69
Mx_u	Ton-m	0.22	0.29	2.13	2.13	3.99	3.99	2.05	2.05	3.92	3.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fy_u	Ton	-0.29	-0.27	0.58	0.58	1.40	1.40	0.64	0.64	1.47	1.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My_u	Ton-m	-0.18	-0.15	1.44	1.44	0.04	0.04	1.48	1.48	0.58	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fx_u	Ton	0.09	0.09	0.82	0.82	0.40	0.40	0.80	0.80	0.28	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'x_u$	Ton-m	0.41	0.37	2.29	2.29	4.41	4.41	2.24	2.24	4.35	4.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'y_u$	Ton-m	0.21	0.18	1.59	1.59	0.06	0.06	1.72	1.72	0.69	0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{xu}	m	0.01	0.01	0.10	0.10	0.04	0.04	0.12	0.12	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{yu}	m	0.02	0.02	0.14	0.14	0.27	0.27	0.18	0.18	0.31	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{xu}/B_x$	-	0.04	0.04	0.37	0.37	0.15	0.15	0.44	0.44	0.18	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{yu}/L_y$	-	0.07	0.08	0.51	0.51	0.98	0.98	0.57	0.57	1.13	1.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
q_{umax}	Ton/m²	8.16	6.69	11.27	11.27	12.76	12.76	10.53	10.53	11.92	11.92	2.82	2.82	2.82	2.82	2.82	2.82	2.82
q_{umin}	Ton/m²	6.50	5.22	0.73	0.73	-0.79	-0.79	-0.05	-0.05	-1.58	-1.58	2.82	2.82	2.82	2.82	2.82	2.82	2.82

ACCION COMO VIGA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
V_u	Ton	5.38	4.40	7.50	7.50	8.42	8.42	6.95	6.95	7.87	7.87	1.86	1.86	1.86	1.86	1.86	1.86	1.86
v_u	Kg/cm²	1.45	1.19	2.02	2.02	2.27	2.27	1.87	1.87	2.12	2.12	0.50	0.50	0.50	0.50	0.50	0.50	0.50
$v_u < \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN X - v_{umax}	Kg/cm²	2.27																
DIRECCION Y																		
V_u	Ton	4.04	3.21	5.63	5.63	6.31	6.31	5.21	5.21	5.90	5.90	1.40	1.40	1.40	1.40	1.40	1.40	1.40
v_u	Kg/cm²	1.09	0.86	1.52	1.52	1.70	1.70	1.40	1.40	1.59	1.59	0.38	0.38	0.38	0.38	0.38	0.38	0.38
$v_u < \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN Y - v_{umax}	Kg/cm²	1.70																

ACCION COMO LOSA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
b_o	cm	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00
V_u	Ton	18.00	14.77	25.09	25.09	28.15	28.15	23.24	23.24	26.30	26.30	6.23	6.23	6.23	6.23	6.23	6.23	6.23
v_u	Kg/cm²	2.76	2.26	3.85	3.85	4.31	4.31	3.56	3.56	4.03	4.03	0.96	0.96	0.96	0.96	0.96	0.96	0.96
$v_u < \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO LOSA - v_{umax}	Kg/cm²	4.31																

DISEÑO A FLEXION EN DOS DIRECCIONES

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
M_{ux}	Ton-cm	**362.61**	**481.31**	**722.73**	**722.73**	**822.21**	**822.21**	**676.66**	**676.66**	**768.12**	**768.12**	**182.02**	**182.02**	**182.02**	**182.02**	**182.02**	**182.02**	**182.02**
K_u	Ton/cm²	0.00315	0.00518	0.00877	0.00877	0.00984	0.00984	0.00812	0.00812	0.00920	0.00920	0.00218	0.00218	0.00218	0.00218	0.00218	0.00218	0.00218
ρ_x (≥ 0.0018)	-	0.00084	0.00109	0.00240	0.00240	0.00270	0.00270	0.00221	0.00221	0.00251	0.00251	0.00058	0.00058	0.00058	0.00058	0.00058	0.00058	0.00058
A_{sx}	cm²	6.68	6.68	8.89	8.89	10.01	10.01	8.23	8.23	9.33	9.33	6.68	6.68	6.68	6.68	6.68	6.68	6.68
Longitud de varilla = B_x - 10	cm	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00
DIRECCION Y																		
M_{uy}	Ton-cm	**371.02**	**304.34**	**517.02**	**517.02**	**890.15**	**890.15**	**475.06**	**475.06**	**541.99**	**541.99**	**126.42**	**126.42**	**126.42**	**126.42**	**126.42**	**126.42**	**126.42**
K_u	Ton/cm²	0.00444	0.00364	0.00619	0.00619	0.00695	0.00695	0.00573	0.00573	0.00649	0.00649	0.00154	0.00154	0.00154	0.00154	0.00154	0.00154	0.00154
ρ_y (≥ 0.0018)	-	0.00126	0.00103	0.00177	0.00177	0.00199	0.00199	0.00164	0.00164	0.00186	0.00186	0.00043	0.00043	0.00043	0.00043	0.00043	0.00043	0.00043
A_{sy}	cm²	6.68	6.68	6.68	8.89	10.01	10.01	8.23	8.23	9.33	9.33	6.68	6.68	6.68	6.68	6.68	6.68	6.68
Longitud de varilla = L_y - 10	cm	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	10.01
A_{sy} Máximo	cm²	10.01
EN SENTIDO X USAR	-	8 VARILLAS No. 4 L = 1.58 m. @ 22.14 cm.
EN SENTIDO Y USAR	-	8 VARILLAS No. 4 L = 1.58 m. @ 22.14 cm.

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE B

ZAPATA CONCENTRICA No. B-2

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	=	2.40	Ton/m³	β =	0.85	-
Peso unitario del suelo (γ_s)	=	1.80	Ton/m³	$\phi v_c = \phi \cdot 0.27 \cdot (2 + 4/\beta_c) \cdot f'_c{}^{0.5}$ =	15.52	Kg/cm²
Capacidad admisible del suelo (q_{adm})	=	12.00	Ton/m²	α_s =	20.00	-
Profundidad de desplante (D)	=	1.50	m	d =	22.50	cm
Area columnas (A_c)	=	0.24	m²	b_o =	290.00	cm
$b_{columna}$ (Sentido X)	=	40.00	cm	$\phi v_c = \phi \cdot 0.27 \cdot (2 + \alpha_s d/b_o) \cdot f'_c{}^{0.5}$ =	11.81	Kg/cm²
$h_{columna}$ (Sentido Y)	=	60.00	cm	$\phi v_c = \phi \cdot 1.1 \cdot f'_c{}^{0.5}$ =	13.55	Kg/cm²
β_c	=	1.50	-			
f_y	=	4,200.00	Kg/cm²	ϕv_c (como losa) =	11.81	Kg/cm²
f'_c	=	210.00	Kg/cm²	$\phi v_c = \phi \cdot 0.53 \cdot f'_c{}^{0.5}$ (como viga) =	6.53	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	COMBINACIONES DE CARGA 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Ancho zapata en el sentido X (B_x)	m	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40
Largo zapata en el sentido Y (L_y)	m	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40
B_{col}/B_{zap}	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d_b columna	cm	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
d_b zapata	cm	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
l_d	cm	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
h zapata req.	m	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
h_z	m	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**
d zapata = (h_z - 0.075)	m	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Area zapata (A)	m²	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
Peso zapata ($W_z = A \cdot h_z \cdot \gamma_c$)	Ton	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41
Peso suelo (W_s)	Ton	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72
Fz	Ton	8.74	8.99	8.93	9.03	8.80	8.80	8.76	8.76	8.97	8.97	8.95	8.95	5.30	5.30	5.27	5.27	0.00
Peso total (W = Fz+Ws+Wz)	Ton	13.86	14.12	14.06	14.16	13.93	13.93	13.89	13.89	14.10	14.10	14.08	14.08	10.43	10.43	10.40	10.40	5.13
Mx	Ton-m	0.29	0.31	0.31	-0.99	0.98	0.98	2.11	2.11	0.84	0.84	1.55	1.55	0.97	0.97	1.99	1.99	0.00
Fx	Ton	-0.25	-0.25	-0.27	0.24	0.06	0.06	0.58	0.58	-0.04	-0.04	0.34	0.34	0.16	0.16	0.66	0.66	0.00
My	Ton-m	-0.52	-0.52	-0.52	-0.52	0.77	0.77	0.04	0.04	0.48	0.48	-0.09	-0.09	0.97	0.97	0.25	0.25	0.00
Fy	Ton	-0.27	-0.27	-0.27	-0.27	0.39	0.39	0.02	0.02	0.23	0.23	-0.05	-0.05	0.50	0.50	0.13	0.13	0.00
M'x = Mx+Fy·h_z	Ton-m	0.37	0.40	0.39	1.08	0.97	0.97	1.94	1.94	0.85	0.85	1.58	1.58	0.82	0.82	1.79	1.79	0.00
M'y = My+Fx·h_z	Ton-m	0.60	0.60	0.60	0.60	0.88	0.88	0.05	0.05	0.52	0.52	0.11	0.11	1.12	1.12	0.29	0.29	0.00
e_x = M'y/W	m	0.04	0.04	0.04	0.04	0.06	0.06	0.00	0.00	0.04	0.04	0.01	0.01	0.11	0.11	0.03	0.03	0.00
e_y = M'x/W	m	0.03	0.03	0.03	0.08	0.07	0.07	0.14	0.14	0.06	0.06	0.11	0.11	0.08	0.08	0.17	0.17	0.00
$6e_x/B_x$	-	0.19	0.18	0.18	0.18	0.27	0.27	0.01	0.01	0.16	0.16	0.03	0.03	0.46	0.46	0.12	0.12	0.00
$6e_y/L_y$	-	0.11	0.12	0.12	0.32	0.30	0.30	0.60	0.60	0.26	0.26	0.48	0.48	0.34	0.34	0.74	0.74	0.00
q_{max}	Ton/m²	**9.19**	**9.38**	**9.34**	**10.89**	**11.18**	**11.18**	**11.42**	**11.42**	**10.19**	**10.19**	**10.07**	**10.07**	**8.87**	**8.87**	**9.08**	**9.08**	**2.62**
q_{min}	Ton/m²	**4.95**	**5.02**	**5.01**	**3.59**	**3.06**	**3.06**	**2.74**	**2.74**	**4.20**	**4.20**	**3.49**	**3.49**	**1.07**	**1.07**	**0.76**	**0.76**	**2.62**
CHEQUEO CAPACIDAD ADMISIBLE	-	O.K.																
DISEÑO ZAPATA - CARGAS MAYORADAS																		
$F_{z,u}$	Ton	12.23	10.89	10.82	10.82	10.79	10.79	7.96	7.96	7.96	7.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peso total mayorado (W_u)	Ton	16.41	16.28	16.21	16.21	16.16	16.16	13.33	13.33	13.26	13.26	5.38	5.38	5.38	5.38	5.38	5.38	5.38
Mx_u	Ton-m	0.41	0.39	1.88	1.88	2.97	2.97	1.25	1.25	2.85	2.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fx_u	Ton	-0.26	-0.35	0.11	0.11	0.63	0.63	0.21	0.21	0.83	0.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My_u	Ton-m	-0.73	-0.82	1.21	1.21	0.18	0.18	1.37	1.37	0.34	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fy_u	Ton	-0.28	-0.33	0.62	0.62	0.09	0.09	0.70	0.70	0.17	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'x_u$	Ton-m	0.51	0.49	1.40	1.40	3.21	3.21	1.32	1.32	3.13	3.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'y_u$	Ton-m	0.84	0.72	1.40	1.40	0.21	0.21	1.58	1.58	0.39	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{xu}	m	0.04	0.04	0.09	0.09	0.01	0.01	0.12	0.12	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{yu}	m	0.03	0.03	0.09	0.09	0.20	0.20	0.10	0.10	0.24	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{xu}/B_x$	-	0.19	0.19	0.37	0.37	0.05	0.05	0.51	0.51	0.12	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{yu}/L_y$	-	0.11	0.13	0.37	0.37	0.85	0.85	0.42	0.42	1.01	1.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$q_{max,u}$	Ton/m²	12.66	10.95	14.38	14.38	15.72	15.72	13.13	13.13	14.47	14.47	2.75	2.75	2.75	2.75	2.75	2.75	2.75
$q_{min,u}$	Ton/m²	6.95	5.66	2.18	2.18	0.77	0.77	0.47	0.47	-0.60	-0.60	2.75	2.75	2.75	2.75	2.75	2.75	2.75
ACCION COMO VIGA																		
DIRECCION X																		
V_u	Ton	4.95	4.22	5.54	5.54	6.05	6.05	5.08	5.08	5.57	5.57	1.06	1.06	1.06	1.06	1.06	1.06	1.06
v_u	Kg/cm²	1.57	1.34	1.76	1.76	1.92	1.92	1.61	1.61	1.77	1.77	0.34	0.34	0.34	0.34	0.34	0.34	0.34
$v_u < \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN X - v_{umax}	Kg/cm²	1.92																
DIRECCION Y																		
V_u	Ton	3.15	2.68	3.52	3.52	3.85	3.85	3.22	3.22	3.55	3.55	0.67	0.67	0.67	0.67	0.67	0.67	0.67
v_u	Kg/cm²	1.00	0.85	1.12	1.12	1.22	1.22	1.02	1.02	1.13	1.13	0.21	0.21	0.21	0.21	0.21	0.21	0.21
$v_u < \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN Y - v_{umax}	Kg/cm²	1.22																
ACCION COMO LOSA																		
b_o	cm	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00
V_u	Ton	18.57	15.81	20.77	20.77	22.71	22.71	18.97	18.97	20.90	20.90	3.97	3.97	3.97	3.97	3.97	3.97	3.97
v_u	Kg/cm²	2.85	2.42	3.18	3.18	3.48	3.48	2.91	2.91	3.20	3.20	0.61	0.61	0.61	0.61	0.61	0.61	0.61
$v_u < \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO LOSA - v_{umax}	Kg/cm²	3.48																
DISEÑO A FLEXION EN DOS DIRECCIONES																		
DIRECCION X																		
M_{ux}	Ton-cm	**228.06**	**393.21**	**503.43**	**503.43**	**580.31**	**580.31**	**459.88**	**459.88**	**506.56**	**506.56**	**96.12**	**96.12**	**96.12**	**96.12**	**96.12**	**96.12**	**96.12**
K_u	Ton/cm²	0.00318	0.00541	0.00710	0.00710	0.00776	0.00776	0.00649	0.00649	0.00715	0.00715	0.00136	0.00136	0.00136	0.00136	0.00136	0.00136	0.00136
ρ	-	0.00085	0.00146	0.00193	0.00193	0.00211	0.00211	0.00176	0.00176	0.00194	0.00194	0.00036	0.00036	0.00036	0.00036	0.00036	0.00036	0.00036
A_{sx}	cm²	5.67	5.67	6.07	6.07	6.66	6.66	5.67	5.67	6.11	6.11	5.67	5.67	5.67	5.67	5.67	5.67	5.67
Longitud de varilla	cm	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00
DIRECCION Y																		
M_{uy}	Ton-cm	**266.07**	**245.38**	**322.15**	**322.15**	**352.20**	**352.20**	**294.16**	**294.16**	**324.20**	**324.20**	**61.82**	**61.82**	**61.82**	**61.82**	**61.82**	**61.82**	**61.82**
K_u	Ton/cm²	0.00408	0.00348	0.00455	0.00455	0.00497	0.00497	0.00415	0.00415	0.00457	0.00457	0.00087	0.00087	0.00087	0.00087	0.00087	0.00087	0.00087
ρ	-	0.00115	0.00098	0.00129	0.00129	0.00142	0.00142	0.00118	0.00118	0.00130	0.00130	0.00024	0.00024	0.00024	0.00024	0.00024	0.00024	0.00024
A_{sy}	cm²	5.67	5.67	6.07	6.07	6.66	6.66	5.67	5.67	6.11	6.11	5.67	5.67	5.67	5.67	5.67	5.67	5.67
Longitud de varilla	cm	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	6.66
A_{sy} Máximo	cm²	6.66
EN SENTIDO X USAR	-	5 VARILLAS No. 4 L = 1.3 m. @ 28 cm.
EN SENTIDO Y USAR	-	5 VARILLAS No. 4 L = 1.3 m. @ 28 cm.

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE B

ZAPATA CONCENTRICA No. B2

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	= 2.40	Ton/m³		β =	0.85	-
Peso unitario del suelo (γ_s)	= 1.80	Ton/m³		[illegible] =	15.52	Kg/cm²
Capacidad admisible del suelo (q_{adm})	= 12.00	Ton/m²		α_s =	20.00	-
Profundidad de desplante (D)	= 1.50	m.		d =	22.50	cm.
Área columnas (A_c)	= 0.24	m²		b_o =	280.00	cm.
$b_{columna}$ (Sentido X)	= 40.00	cm.		[illegible] =	11.81	Kg/cm²
$h_{columna}$ (Sentido Y)	= 60.00	cm.		[illegible] =	13.55	Kg/cm²
β_c	= 1.50	-				
f_y	= 4,200.00	Kg/cm²		ϕv_c (como losa) =	11.81	Kg/cm²
f'_c	= 210.00	Kg/cm²		[illegible] (como viga) =	9.53	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	1	2	3	4	5
Ancho zapata en el sentido X (B_x)	m.	1.40	1.40	1.40	1.40	1.40
Largo zapata en el sentido Y (L_y)	m.	1.40	1.40	1.40	1.40	1.40
[illegible]	-	1.00	1.00	1.00	1.00	1.00
[illegible] columna	cm.	1.91	1.91	1.91	1.91	1.91
[illegible] zapata	cm.	1.27	1.27	1.27	1.27	1.27
[illegible]	cm.	44.17	44.17	44.17	44.17	44.17
h zapata req. [illegible]	m.	0.56	0.56	0.56	0.56	0.56
[illegible]	m.	0.30	0.30	0.30	0.30	0.30
d zapata = [illegible]	m.	0.23	0.23	0.23	0.23	0.23
Área zapata (A)	m²	1.96	1.96	1.96	1.96	1.96
Peso zapata [illegible]	Ton	1.41	1.41	1.41	1.41	1.41
Peso suelo [illegible]	Ton	3.72	3.72	3.72	3.72	3.72
Fz	Ton	8.08	8.32	8.26	8.44	8.14
Peso total [illegible]	Ton	13.20	13.45	13.39	13.56	13.26
Mx	Ton-m	0.22	0.34	0.32	-0.94	1.18
Fy	Ton	-0.26	-0.29	-0.26	0.21	0.12
My	Ton-m	-0.65	-0.65	-0.65	-0.65	0.64
Fx	Ton	-0.29	-0.39	-0.39	-0.29	0.28

DISEÑO ZAPATA - CARGAS MAYORADAS

ACCION COMO VIGA

ACCION COMO LOSA

DISEÑO A FLEXION EN DOS DIRECCIONES

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	6.00
A_{sy} Máximo	cm²	6.00
EN SENTIDO X USAR	-	5 VARILLAS No. 4 L = 1.3 m. @ 22.5 cm.
EN SENTIDO Y USAR	-	5 VARILLAS No. 4 L = 1.3 m. @ 22.5 cm.

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE B

ZAPATA CONCENTRICA No. B4

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	= 2.40	Ton/m³	[illegible] =	0.00	-
Peso unitario del suelo (γ_s)	= 1.80	Ton/m³	ϕv_c = [illegible] =	15.52	Kg/cm²
Capacidad admisible del suelo (q_{adm})	= 12.00	Ton/m²	α_s =	20.00	-
Profundidad de desplante (D)	= 1.50	m	d =	22.50	cm
Área columnas (A_c)	= 0.24	m²	b_o =	290.00	cm
$b_{columna}$ (Sentido X)	= 40.00	cm	ϕv_c = [illegible] =	11.01	Kg/cm²
$t_{columna}$ (Sentido Y)	= 60.00	cm	ϕv_c = [illegible] =	13.05	Kg/cm²
β_c	= 1.50	-			
f_y	= 4,200.00	Kg/cm²	ϕv_c (como losa) =	11.01	Kg/cm²
f'_c	= 210.00	Kg/cm²	ϕv_c = [illegible] (como viga) =	6.53	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		COMBINACIONES DE CARGA																
Ancho zapata en el sentido X (B_x)	m	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65
Largo zapata en el sentido Y (L_y)	m	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65
[illegible]	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d_b columna	cm	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
d_b zapata	cm	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
l_d = [illegible]	cm	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
h zapata req. H = [illegible]	m	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
h_z	m	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**
d zapata = (h_z - 0.075)	m	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Área zapata (A)	m²	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72
Peso zapata (W_z = A*h*γ_c)	Ton	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
Peso suelo (W_s = [illegible])	Ton	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36
Fz	Ton	10.41	10.54	10.50	10.59	10.64	10.69	10.51	10.51	10.69	10.69	10.58	10.58	6.48	6.48	6.35	6.35	0.00
Peso total (Wz + Fz+Ws+Wc)	Ton	17.73	17.88	17.83	17.95	17.96	17.96	17.83	17.83	18.01	18.01	17.91	17.91	13.80	13.80	13.67	13.67	7.32
Mx	Ton-m	-0.35	-0.36	-0.36	-1.00	1.81	1.81	2.51	2.51	1.49	1.49	1.89	1.89	1.67	1.67	2.37	2.37	0.00
Fy	Ton	-0.29	-0.29	-0.29	0.29	0.86	0.86	0.70	0.70	0.21	0.21	0.46	0.46	0.50	0.50	0.62	0.62	0.00
My	Ton-m	0.74	0.74	0.74	0.74	1.86	1.86	1.23	1.23	1.59	1.59	1.11	1.11	1.56	1.56	0.63	0.63	0.00
Fx	Ton	0.83	0.83	0.83	0.82	1.34	1.34	1.05	1.05	1.22	1.22	1.00	1.00	1.01	1.01	0.72	0.72	0.00
M'x = Mx+Fy*hz	Ton-m	0.44	0.45	0.45	1.09	1.69	1.69	2.30	2.30	1.40	1.40	1.86	1.86	1.52	1.52	2.13	2.13	0.00
M'y = My+ Fx*hz	Ton-m	0.99	0.99	0.99	0.99	2.26	2.26	1.54	1.54	1.95	1.95	1.41	1.41	1.87	1.87	1.15	1.15	0.00
e_x = M'y/Wt	m	0.06	0.06	0.06	0.06	0.13	0.13	0.09	0.09	0.11	0.11	0.08	0.08	0.14	0.14	0.08	0.08	0.00
e_y = M'x/Wt	m	0.02	0.03	0.03	0.06	0.09	0.09	0.13	0.13	0.08	0.08	0.10	0.10	0.11	0.11	0.16	0.16	0.00
$6e_x/B_x$	-	0.20	0.20	0.20	0.20	0.46	0.46	0.31	0.31	0.39	0.39	0.29	0.29	0.49	0.49	0.31	0.31	0.00
$6e_y/L_y$	-	0.08	0.09	0.09	0.22	0.34	0.34	0.47	0.47	0.28	0.28	0.38	0.38	0.40	0.40	0.57	0.57	0.00
q_{max} = [illegible]	Ton/m²	**8.42**	**8.45**	**8.46**	**9.35**	**11.05**	**11.05**	**11.88**	**11.88**	**11.09**	**11.09**	**10.94**	**10.94**	**9.59**	**9.59**	**9.39**	**9.39**	**2.69**
q_{min} = [illegible]	Ton/m²	**4.61**	**4.64**	**4.65**	**3.91**	**1.31**	**1.31**	**1.42**	**1.42**	**2.14**	**2.14**	**2.22**	**2.22**	**0.85**	**0.85**	**0.86**	**0.86**	**2.69**
CHEQUEO CAPACIDAD ADMISIBLE	-	O.K.																
DISEÑO ZAPATA - CARGAS MAYORADAS																		
Fz_u	Ton	14.57	12.70	12.96	12.96	12.77	12.77	9.70	9.70	9.52	9.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peso total mayorado (W_{tu} = [illegible])	Ton	24.82	20.39	20.65	20.65	20.46	20.46	17.39	17.39	17.20	17.20	7.69	7.69	7.69	7.69	7.69	7.69	7.69
Mx_u	Ton-m	0.50	0.44	2.51	2.51	2.07	2.01	2.40	2.40	2.40	2.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fy_u	Ton	-0.42	-0.36	0.80	0.80	1.06	1.06	0.70	0.70	1.15	1.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My_u	Ton-m	1.03	0.89	2.49	2.49	1.58	1.58	2.26	2.26	1.26	1.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fx_u	Ton	1.15	0.99	1.73	1.73	1.21	1.21	1.49	1.49	1.07	1.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'x_u$ = Mx_u+Fy_u*h_z	Ton-m	0.62	0.54	2.69	2.69	3.03	3.03	2.61	2.61	3.75	3.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'y_u$ = My_u+ Fx_u*h_z	Ton-m	1.38	1.18	3.01	3.01	1.96	1.96	2.71	2.71	1.58	1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{xu} = $M'y_u/W_{tu}$	m	0.06	0.06	0.15	0.15	0.10	0.10	0.16	0.16	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{yu} = $M'x_u/W_{tu}$	m	0.03	0.03	0.13	0.13	0.15	0.15	0.15	0.15	0.22	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{xu}/B_x$	-	0.20	0.21	0.53	0.53	0.35	0.35	0.57	0.57	0.36	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{yu}/L_y$	-	0.09	0.10	0.47	0.47	0.55	0.55	0.55	0.55	0.79	0.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00
q_{umax} = [illegible]	Ton/m²	11.78	9.60	15.19	15.19	15.27	15.27	13.49	13.49	13.57	13.57	2.82	2.82	2.82	2.82	2.82	2.82	2.82
q_{umin} = [illegible]	Ton/m²	6.45	5.18	-0.03	-0.03	-0.24	-0.24	-0.71	-0.71	-0.60	-0.60	2.82	2.82	2.82	2.82	2.82	2.82	2.82
ACCION COMO VIGA																		
DIRECCION X																		
V_u = [illegible]	Ton	7.76	6.46	10.03	10.03	10.08	10.08	8.90	8.90	8.96	8.96	1.86	1.86	1.86	1.86	1.86	1.86	1.86
v_u = [illegible]	Kg/cm²	2.09	1.74	2.70	2.70	2.72	2.72	2.40	2.40	2.41	2.41	0.50	0.50	0.50	0.50	0.50	0.50	0.50
v_u < ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN X - v_{umax}	Kg/cm²	2.72																
DIRECCION Y																		
V_u = [illegible]	Ton	5.83	4.85	7.52	7.52	7.56	7.56	6.68	6.68	6.72	6.72	1.40	1.40	1.40	1.40	1.40	1.40	1.40
v_u = [illegible]	Kg/cm²	1.57	1.31	2.03	2.03	2.04	2.04	1.80	1.80	1.81	1.81	0.38	0.38	0.38	0.38	0.38	0.38	0.38
v_u < ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN Y - v_{umax}	Kg/cm²	2.04																
ACCION COMO LOSA																		
b_o	cm	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00
V_u = [illegible]	Ton	[illegible]	21.62	33.53	33.53	33.71	33.71	29.77	29.77	29.90	29.90	6.23	6.23	6.23	6.23	6.23	6.23	6.23
v_u = [illegible]	Kg/cm²	3.69	3.31	5.14	5.14	5.17	5.17	4.56	4.56	4.58	4.58	0.96	0.96	0.96	0.96	0.96	0.96	0.96
v_u < ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO LOSA - v_{umax}	Kg/cm²	5.17																
DISEÑO A FLEXION EN DOS DIRECCIONES																		
DIRECCION X																		
M_{ux} = [illegible]	Ton-cm	**576.71**	**501.22**	**879.33**	**879.33**	**864.39**	**864.39**	**856.54**	**856.54**	**874.82**	**874.82**	**182.02**	**182.02**	**182.02**	**182.02**	**182.02**	**182.02**	**182.02**
K_u = [illegible]	Ton/cm²	[illegible]	[illegible]	0.01173	0.01173	0.01178	0.01178	0.01041	0.01041	0.01047	0.01047	0.00218	0.00218	0.00218	0.00218	0.00218	0.00218	0.00218
ρ = [illegible] ≥ 0.0018	-	0.00122	0.00106	0.00323	0.00323	0.00325	0.00325	0.00288	0.00288	0.00289	0.00289	0.00058	0.00058	0.00058	0.00058	0.00058	0.00058	0.00058
A_{sx} = [illegible]	cm²	6.68	7.63	12.01	12.01	12.07	12.07	10.81	10.81	10.88	10.88	6.68	6.68	6.68	6.68	6.68	6.68	6.68
Longitud de varilla = B_x - 10	cm	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00
DIRECCION Y																		
M_{uy} = [illegible]	Ton-cm	**535.99**	**445.40**	**591.01**	**591.01**	**594.39**	**594.39**	**613.50**	**613.50**	**617.13**	**617.13**	**128.43**	**128.43**	**128.43**	**128.43**	**128.43**	**128.43**	**128.43**
K_u = [illegible]	Ton/cm²	0.00641	0.00533	0.00827	0.00827	0.00832	0.00832	0.00735	0.00735	0.00738	0.00738	0.00154	0.00154	0.00154	0.00154	0.00154	0.00154	0.00154
ρ = [illegible] ≥ 0.0018	-	0.00194	0.00153	0.00238	0.00238	0.00240	0.00240	0.00211	0.00211	0.00212	0.00212	0.00043	0.00043	0.00043	0.00043	0.00043	0.00043	0.00043
A_{sy} = [illegible]	cm²	6.68	7.63	12.01	12.01	12.07	12.07	10.81	10.81	10.88	10.88	6.68	6.68	6.68	6.68	6.68	6.68	6.68
Longitud de varilla = L_y - 10	cm	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	12.07
A_{sy} Máximo	cm²	12.07
EN SENTIDO X USAR	-	10 VARILLAS No. 4 L = 1.55 m. @ 17.22 cm.
EN SENTIDO Y USAR	-	10 VARILLAS No. 4 L = 1.55 m. @ 17.22 cm.

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE B

ZAPATA CONCENTRICA No. A-1

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	=	2.40	Ton/m³			
Peso unitario del suelo (γ_s)	=	1.80	Ton/m³	v_{c1} =	15.52	Kg/cm²
Capacidad admisible del suelo (q_{adm})	=	12.00	Ton/m²	α_s =	20.00	-
Profundidad de desplante (D)	=	1.50	m	d =	22.50	cm
Area columnas (A_c)	=	0.24	m²	b_0 =	280.00	cm
$b_{columna}$ (Sentido X)	=	40.00	cm	v_{c2} =	11.81	Kg/cm²
$t_{columna}$ (Sentido Y)	=	60.00	cm	v_{c3} =	13.55	Kg/cm²
β_c	=	1.50	-			
f_y	=	4,200.00	Kg/cm²	v_c (como losa) =	11.81	Kg/cm²
f'_c	=	210.00	Kg/cm²	v_c (como viga) =	6.52	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

CHEQUEO CAPACIDAD ADMISIBLE: O.K.

DISEÑO ZAPATA - CARGAS MAYORADAS

ACCION COMO VIGA

CHEQUEO ACCION COMO VIGA EN X - V_{cdisp}: 2.28

CHEQUEO ACCION COMO VIGA EN Y - V_{cdisp}: 1.22

ACCION COMO LOSA

CHEQUEO ACCION COMO LOSA - V_{cdisp}: 4.57

DISEÑO A FLEXION EN DOS DIRECCIONES

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	12.19
A_{sy} Máximo	cm²	12.19
EN SENTIDO X USAR	-	10 VARILLAS No. 4 L = 1.75 m. @ 18.44 cm.
EN SENTIDO Y USAR	-	10 VARILLAS No. 4 L = 1.75 m. @ 18.44 cm.

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE B

ZAPATA CONCENTRICA No. A2

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	= 2.40	Ton/m³	ϕ =	0.85	-
Peso unitario del suelo (γ_s)	= 1.80	Ton/m³	$\phi v_c = \phi \cdot 0.27 \cdot (2+4/\beta_c)\cdot(f'_c)^{0.5}$ =	15.62	Kg/cm²
Capacidad admisible del suelo (q_{adm})	= 12.00	Ton/m²	α_s =	20.00	-
Profundidad de desplante (D)	= 1.50	m.	d =	22.50	cm.
Area columnas (A_c)	= 0.24	m²	b_o =	290.00	cm.
b_{col} (Sentido X)	= 40.00	cm.	$\phi v_c = \phi \cdot 0.27 \cdot (2+\alpha_s d/b_o)\cdot(f'_c)^{0.5}$ =	11.81	Kg/cm²
h_{col} (Sentido Y)	= 60.00	cm.	$\phi v_c = \phi \cdot 1.1 \cdot (f'_c)^{0.5}$ =	13.55	Kg/cm²
β_c	= 1.50	-			
f_y	= 4,200.00	Kg/cm²	ϕv_c (como losa) =	11.81	Kg/cm²
f'_c	= 210.00	Kg/cm²	$\phi v_c = \phi \cdot 0.53 \cdot (f'_c)^{0.5}$ (como viga) =	6.52	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	COMBINACIONES DE CARGA																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Ancho zapata en el sentido X (B_x)	m.	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65
Largo zapata en el sentido Y (L_y)	m.	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65
[illegible]	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
[illegible] columnas	cm.	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
[illegible] zapata	cm.	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
d = [illegible]	cm.	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
h zapata req. H = [illegible]	m.	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
h	m.	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**
d zapata = (h - 0.075)	m.	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Area zapata (A)	m²	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72
Peso zapata (W_z = [illegible])	Ton	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
Peso suelo (W_s = [illegible])	Ton	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36	5.36
Fz	Ton	6.56	6.67	6.63	7.62	6.61	6.61	6.69	6.69	6.71	6.71	6.77	6.77	4.01	4.01	4.09	4.09	0.00
Peso total (Wt = Fz+Ws+Wz)	Ton	13.92	13.99	13.95	15.15	13.93	13.93	14.01	14.01	14.03	14.03	14.09	14.09	11.33	11.33	11.41	11.41	7.32
Mx	Ton-m	0.65	0.65	0.65	-0.49	1.27	1.27	2.27	2.27	1.12	1.12	1.67	1.67	1.01	1.01	2.00	2.00	0.00
Fy	Ton	-0.58	-0.58	-0.58	-0.23	-0.34	-0.34	0.05	0.05	-0.46	-0.46	-0.11	-0.11	-0.11	-0.11	0.28	0.28	0.00
My	Ton-m	-0.51	-0.51	-0.51	-0.56	0.86	0.86	0.70	0.70	0.52	0.52	0.41	0.41	1.07	1.07	0.90	0.90	0.00
Fx	Ton	-0.27	-0.27	-0.27	-0.27	0.43	0.43	0.35	0.35	0.26	0.26	0.20	0.20	0.54	0.54	0.46	0.46	0.00
M'x = Mx+Fy*h	Ton-m	0.60	0.60	0.60	0.40	1.37	1.37	2.25	2.25	1.24	1.24	1.91	1.91	1.04	1.04	1.92	1.92	0.00
M'y = My+Fx*h	Ton-m	0.59	0.59	0.58	0.58	0.99	0.99	0.81	0.81	0.61	0.61	0.47	0.47	1.23	1.23	1.04	1.04	0.00
e_x = M'y/Wt	m.	0.04	0.04	0.04	0.04	0.07	0.07	0.06	0.06	0.04	0.04	0.03	0.03	0.11	0.11	0.09	0.09	0.00
e_y = M'x/Wt	m.	0.06	0.06	0.06	0.03	0.10	0.10	0.16	0.16	0.09	0.09	0.14	0.14	0.09	0.09	0.17	0.17	0.00
$6e_x/B_x$	-	0.15	0.15	0.15	0.14	0.26	0.26	0.21	0.21	0.16	0.16	0.12	0.12	0.39	0.39	0.33	0.33	0.00
$6e_y/L_y$	-	0.22	0.22	0.22	0.10	0.36	0.36	0.58	0.58	0.32	0.32	0.49	0.49	0.33	0.33	0.61	0.61	0.00
q_{max}	Ton/m²	**6.98**	**7.04**	**7.02**	**6.90**	**8.27**	**8.27**	**8.22**	**8.22**	**7.80**	**7.80**	**8.38**	**8.38**	**7.19**	**7.19**	**8.16**	**8.16**	**2.69**
q_{min}	Ton/m²	**3.17**	**3.24**	**3.25**	**4.23**	**1.96**	**1.96**	**1.08**	**1.08**	**2.80**	**2.80**	**2.01**	**2.01**	**1.13**	**1.13**	**0.20**	**0.20**	**2.69**
CHEQUEO CAPACIDAD ADMISIBLE	-	O.K.																

DISEÑO ZAPATA - CARGAS MAYORADAS

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Fz_u	Ton	8.13	8.07	8.12	8.12	8.24	8.24	8.00	8.00	8.12	8.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peso total mayorado (W_{tu} = [illegible])	Ton	16.06	15.76	15.61	15.61	15.93	15.93	13.69	13.69	13.81	13.81	7.69	7.69	7.69	7.69	7.69	7.69	7.69
Mx_u	Ton-m	0.92	0.79	1.66	1.66	2.06	2.06	1.47	1.47	2.59	2.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fy_u	Ton	-0.67	-0.70	-0.36	-0.36	0.19	0.19	-0.18	-0.18	0.27	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My_u	Ton-m	-0.72	-0.61	1.35	1.35	1.12	1.12	1.56	1.56	1.27	1.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fx_u	Ton	-0.39	-0.33	0.66	0.66	0.57	0.57	0.77	0.77	0.65	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'x_u = Mx_u+Fy_u h$	Ton-m	1.19	0.86	1.77	1.77	3.14	3.14	1.52	1.52	3.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'y_u = My_u+Fx_u h$	Ton-m	0.65	0.71	1.55	1.55	1.29	1.29	1.73	1.73	1.47	1.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$e_x = M'y_u/W_{tu}$	m.	0.04	0.05	0.10	0.10	0.08	0.08	0.13	0.13	0.11	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$e_y = M'x_u/W_{tu}$	m.	0.06	0.06	0.11	0.11	0.20	0.20	0.11	0.11	0.22	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_x/B_x$	-	0.16	0.15	0.36	0.36	0.29	0.29	0.46	0.46	0.39	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_y/L_y$	-	0.22	0.23	0.41	0.41	0.73	0.73	0.40	0.40	0.79	0.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00
q_{umax}	Ton/m²	8.77	8.07	10.26	10.26	11.77	11.77	9.37	9.37	11.04	11.04	2.83	2.83	2.83	2.83	2.83	2.83	2.83
q_{umin}	Ton/m²	4.66	3.51	1.37	1.37	-0.07	-0.07	0.69	0.69	-0.89	-0.89	2.83	2.83	2.83	2.83	2.83	2.83	2.83

ACCION COMO VIGA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
V_u	Ton	6.45	5.32	6.76	6.76	7.77	7.77	6.19	6.19	7.25	7.25	1.86	1.86	1.86	1.86	1.86	1.86	1.86
v_u	Kg/cm²	1.74	1.43	1.82	1.82	2.09	2.09	1.67	1.67	1.95	1.95	0.50	0.50	0.50	0.50	0.50	0.50	0.50
$v_u \le \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN X - v_{umax}	Kg/cm²	2.09																
DIRECCION Y																		
V_u	Ton	4.84	3.99	5.07	5.07	5.82	5.82	4.64	4.64	5.46	5.46	1.40	1.40	1.40	1.40	1.40	1.40	1.40
v_u	Kg/cm²	1.30	1.08	1.37	1.37	1.57	1.57	1.25	1.25	1.47	1.47	0.38	0.38	0.38	0.38	0.38	0.38	0.38
$v_u \le \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN Y - v_{umax}	Kg/cm²	1.57																

ACCION COMO LOSA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
b_o	cm.	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00
V_u	Ton	21.57	17.80	22.61	22.61	25.97	25.97	20.69	20.69	24.36	24.36	6.23	6.23	6.23	6.23	6.23	6.23	6.23
v_u	Kg/cm²	3.31	2.73	3.47	3.47	3.98	3.98	3.17	3.17	3.73	3.73	0.96	0.96	0.96	0.96	0.96	0.96	0.96
$v_u \le \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO LOSA - v_{umax}	Kg/cm²	3.98																

DISEÑO A FLEXION EN DOS DIRECCIONES

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
M_u	Ton-cm	**314.94**	**320.00**	**660.34**	**660.34**	**789.43**	**789.43**	**604.11**	**604.11**	**711.38**	**711.38**	**182.02**	**182.02**	**182.02**	**182.02**	**182.02**	**182.02**	**182.02**
K_u	Ton/cm²	0.00377	0.00603	0.00791	0.00791	0.00908	0.00908	0.00723	0.00723	0.00852	0.00852	0.00218	0.00218	0.00218	0.00218	0.00218	0.00218	0.00218
ρ = [illegible] > 0.0018	-	0.00101	0.00169	0.00215	0.00215	0.00246	0.00246	0.00196	0.00196	0.00232	0.00232	0.00058	0.00058	0.00058	0.00058	0.00058	0.00058	0.00058
A_{sx}	cm²	6.68	6.68	7.99	7.99	9.21	9.21	7.29	7.29	8.62	8.62	6.68	6.68	6.68	6.68	6.68	6.68	6.68
Longitud de varilla = B_x - 10	cm.	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00
DIRECCION Y																		
M_u	Ton-cm	**444.40**	**366.91**	**466.90**	**466.90**	**535.14**	**535.14**	**426.26**	**426.26**	**501.40**	**501.40**	**128.43**	**128.43**	**128.43**	**128.43**	**128.43**	**128.43**	**128.43**
K_u	Ton/cm²	0.00532	0.00439	0.00559	0.00559	0.00641	0.00641	0.00510	0.00510	0.00601	0.00601	0.00154	0.00154	0.00154	0.00154	0.00154	0.00154	0.00154
ρ = [illegible] > 0.0018	-	0.00152	0.00125	0.00159	0.00159	0.00183	0.00183	0.00145	0.00145	0.00172	0.00172	0.00043	0.00043	0.00043	0.00043	0.00043	0.00043	0.00043
A_{sy}	cm²	6.68	6.68	7.99	7.99	9.21	9.21	7.29	7.29	8.62	8.62	6.68	6.68	6.68	6.68	6.68	6.68	6.68
Longitud de varilla = L_y - 10	cm.	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	9.21
A_{sy} Máximo	cm²	9.21
EN SENTIDO X USAR	-	8 VARILLAS No. 4 L = 1.56 m. @ 22.14 cm.
EN SENTIDO Y USAR	-	8 VARILLAS No. 4 L = 1.56 m. @ 22.14 cm.

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE B

ZAPATA CONCENTRICA No. A4

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	= 2.40	Ton/m³	ϕ =	0.85	-
Peso unitario del suelo (γ_s)	= 1.80	Ton/m³		15.52	Kg/cm²
Capacidad admisible del suelo (q_{adm})	= 12.00	Ton/m²		20.00	-
Profundidad de desplante (D)	= 1.50	m	d =	22.50	cm
Area columnas (A_c)	= 0.24	m²	b_o =	290.00	cm
(Sentido X)	= 40.00	cm		11.81	Kg/cm²
(Sentido Y)	= 60.00	cm		13.55	Kg/cm²
	= 1.50	-			
f_y	= 4,200.00	Kg/cm²		11.81	Kg/cm²
f'_c	= 210.00	Kg/cm²		6.53	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DISEÑO ZAPATA - CARGAS MAYORADAS

ACCION COMO VIGA

ACCION COMO LOSA

DISEÑO A FLEXION EN DOS DIRECCIONES

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	8.77
A_{sy} Máximo	cm²	8.77
EN SENTIDO X USAR	-	7 VARILLAS No. 4 L = 1.55 m. @ 25.00 cm.
EN SENTIDO Y USAR	-	7 VARILLAS No. 4 L = 1.55 m. @ 25.00 cm.

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE B

ZAPATA CONCENTRICA No. A4

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	=	2.40	Ton/m³	α =	0.60	-
Peso unitario del suelo (γ_s)	=	1.80	Ton/m³	$\phi v_c = \phi*0.27*(2+4/\beta_c)*(f'_c)^{1/2}$ =	15.32	Kg/cm²
Capacidad admisible del suelo (q_{adm})	=	12.00	Ton/m²	α_s =	20.00	-
Profundidad de desplante (D)	=	1.50	m	d =	22.50	cm
Area columnas (A_c)	=	0.24	m²	b_o =	290.00	cm
$b_{columna}$ (Sentido X)	=	40.00	cm	$\phi v_c = \phi*0.27*(2+\alpha_s*d/b_o)*(f'_c)^{1/2}$ =	11.01	Kg/cm²
$h_{columna}$ (Sentido Y)	=	60.00	cm	$\phi v_c = \phi*1.1*(f'_c)^{1/2}$ =	13.00	Kg/cm²
β_c	=	1.50	-			
f_y	=	4,200.00	Kg/cm²	ϕv_c (como losa) =	11.01	Kg/cm²
f'_c	=	210.00	Kg/cm²	$\phi v_c = \phi*0.53*(f'_c)^{1/2}$ (como viga) =	6.53	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

COMBINACIONES DE CARGA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Ancho zapata en el sentido X (B_x)	m	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85
Largo zapata en el sentido Y (L_y)	m	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85
A_{req} / A_{real}	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d_b columna	cm	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
d_b zapata	cm	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
l_d = 0.075*d_b*f_y/$f'_c^{1/2}$*(As,req/As,sum) > 0.0043*f_y*d_b	cm	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
h zapata req. H = [ld+$d_{b,zapata}$+2*$d_{b,zapata}$+7.5]/100	m	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
h_z	m	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
d zapata = (h_z - 0.075)	m	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Area zapata (A)	m²	3.42	3.42	3.42	3.42	3.42	3.42	3.42	3.42	3.42	3.42	3.42	3.42	3.42	3.42	3.42	3.42	3.42
Peso zapata (W_z = A*h_z*γ_c)	Ton	2.46	2.46	2.46	2.46	2.46	2.46	2.46	2.46	2.46	2.46	2.46	2.46	2.46	2.46	2.46	2.46	2.46
Peso suelo (W_s = γ_s*(A-A_c)*(D-h_z))	Ton	6.87	6.87	6.87	6.87	6.87	6.87	6.87	6.87	6.87	6.87	6.87	6.87	6.87	6.87	6.87	6.87	6.87
Fz	Ton	7.00	7.09	7.06	7.62	7.27	7.27	7.21	7.21	7.27	7.27	7.22	7.22	4.48	4.48	4.41	4.41	0.00
Peso total (Wt = Fz+Ws+Wz)	Ton	16.33	16.42	16.42	16.81	16.61	16.61	16.55	16.55	16.61	16.61	16.57	16.57	13.81	13.81	13.75	13.75	9.34
Mx	Ton-m	0.91	0.91	0.91	-0.29	2.20	2.20	2.84	2.84	1.90	1.90	2.37	2.37	1.65	1.65	2.49	2.49	0.00
Fy	Ton	-0.78	-0.78	-0.78	-0.25	-0.25	-0.25	0.00	0.00	-0.28	-0.28	-0.19	-0.19	0.06	0.06	0.31	0.31	0.00
My	Ton-m	0.12	0.12	0.12	0.13	1.21	1.21	1.19	1.19	1.02	1.02	0.63	0.63	1.26	1.26	1.14	1.14	0.00
Fx	Ton	0.27	0.27	0.27	0.27	0.63	0.63	0.78	0.78	0.69	0.69	0.66	0.66	0.72	0.72	0.67	0.67	0.00
M'x = Mx+Fy*h_z	Ton-m	1.15	1.14	1.14	0.18	2.29	2.29	2.84	2.84	2.01	2.01	2.43	2.43	1.63	1.63	2.38	2.38	0.00
M'y = My-Fx*h_z	Ton-m	0.20	0.20	0.20	0.19	1.56	1.56	1.42	1.42	1.20	1.20	1.13	1.13	1.48	1.48	1.34	1.34	0.00
e_x = M'y/Wt	m	0.01	0.01	0.01	0.01	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.11	0.11	0.10	0.10	0.00
e_y = M'x/Wt	m	0.07	0.07	0.07	0.01	0.14	0.14	0.17	0.17	0.12	0.12	0.15	0.15	0.13	0.13	0.17	0.17	0.00
$6e_x/B_x$	-	0.04	0.04	0.04	0.04	0.30	0.30	0.28	0.28	0.24	0.24	0.22	0.22	0.35	0.35	0.32	0.32	0.00
$6e_y/L_y$	-	0.23	0.23	0.23	0.03	0.45	0.45	0.56	0.56	0.39	0.39	0.48	0.48	0.43	0.43	0.56	0.56	0.00
q_{max} = (Wt/Bx*Ly)*(1+6ex/Bx+6ey/Ly)	Ton/m²	6.86	6.07	6.07	6.31	6.90	6.90	8.86	8.86	7.93	7.93	8.21	8.21	7.18	7.18	7.88	7.88	2.72
q_{min} = (Wt/Bx*Ly)*(1-6ex/Bx-6ey/Ly)	Ton/m²	3.49	3.63	3.63	4.81	1.26	1.26	0.90	0.90	1.75	1.75	1.47	1.47	0.90	0.90	0.49	0.49	2.72
CHEQUEO CAPACIDAD ADMISIBLE	-	O.K.																

DISEÑO ZAPATA - CARGAS MAYORADAS

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Fz_u	Ton	8.79	8.54	8.88	8.88	8.79	8.79	6.69	6.69	6.60	6.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peso total mayorado (W_{tu} = Fz_u+W_{su}+W_{zu})	Ton	22.87	18.34	18.64	18.64	18.80	18.80	16.50	16.50	16.41	16.41	8.81	8.81	8.81	8.81	8.81	8.81	8.81
Mx_u	Ton-m	1.28	1.09	2.95	2.95	2.64	2.64	2.88	2.88	2.58	2.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fy_u	Ton	-1.13	-0.89	-0.19	-0.19	0.17	0.17	0.05	0.05	0.47	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My_u	Ton-m	0.15	0.19	1.85	1.85	1.87	1.87	1.81	1.81	1.63	1.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fx_u	Ton	0.26	0.32	1.12	1.12	1.05	1.05	1.04	1.04	0.97	0.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'x_u$ = Mx_u+Fy_u*h_z	Ton-m	1.61	1.37	3.00	3.00	2.90	2.90	2.70	2.70	2.70	2.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'y_u$ = My_u-Fx_u*h_z	Ton-m	0.39	0.24	2.18	2.18	1.98	1.98	2.12	2.12	1.92	1.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{xu} = $M'y_u$/W_{tu}	m	0.01	0.01	0.12	0.12	0.11	0.11	0.13	0.13	0.12	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{yu} = $M'x_u$/W_{tu}	m	0.07	0.07	0.16	0.16	0.21	0.21	0.16	0.16	0.22	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{xu}/B_x$	-	0.04	0.04	0.38	0.38	0.35	0.35	0.42	0.42	0.38	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{yu}/L_y$	-	0.23	0.24	0.52	0.52	0.68	0.68	0.53	0.53	0.73	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$q_{max,u}$ = (W_{tu}/Bx*Ly)*(1+6exu/Bx+6eyu/Ly)	Ton/m²	8.47	6.88	10.36	10.36	11.01	11.01	8.39	8.39	10.12	10.12	2.86	2.86	2.86	2.86	2.86	2.86	2.86
$q_{min,u}$ = (W_{tu}/Bx*Ly)*(1-6exu/Bx-6eyu/Ly)	Ton/m²	4.89	3.84	0.64	0.64	0.14	0.14	-0.33	-0.33	-0.53	-0.53	2.86	2.86	2.86	2.86	2.86	2.86	2.86

ACCION COMO VIGA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
V_u = $q_{max,u}$*L_y*((Bx-b)/2-d)	Ton	7.84	6.07	8.80	8.80	10.19	10.19	8.68	8.68	9.38	9.38	2.65	2.65	2.65	2.65	2.65	2.65	2.65
v_u = V_u/(L_y*d*10)	Kg/cm²	1.86	1.53	2.21	2.21	2.45	2.45	2.09	2.09	2.25	2.25	0.64	0.64	0.64	0.64	0.64	0.64	0.64
v_u < ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN X - $v_{u,max}$	Kg/cm²	2.45																
DIRECCION Y																		
V_u = $q_{max,u}$*B_x*((Ly-h)/2-d)	Ton	6.27	5.09	7.68	7.68	8.14	8.14	6.95	6.95	7.49	7.49	2.12	2.12	2.12	2.12	2.12	2.12	2.12
v_u = V_u/(B_x*d*10)	Kg/cm²	1.51	1.22	1.84	1.84	1.96	1.96	1.67	1.67	1.80	1.80	0.51	0.51	0.51	0.51	0.51	0.51	0.51
v_u < ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN Y - $v_{u,max}$	Kg/cm²	1.96																

ACCION COMO LOSA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
b_o	cm	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00	290.00
V_u = $q_{max,u}$*(A-(b+d)*(h+d))	Ton	24.83	20.01	30.15	30.15	31.86	31.86	27.29	27.29	29.42	29.42	8.33	8.33	8.33	8.33	8.33	8.33	8.33
v_u = V_u/b_o*d	Kg/cm²	3.77	3.07	4.60	4.60	4.86	4.86	4.15	4.15	4.51	4.51	1.28	1.28	1.28	1.28	1.28	1.28	1.28
v_u < ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO LOSA - $v_{u,max}$	Kg/cm²	4.86																

DISEÑO A FLEXION EN DOS DIRECCIONES

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
M_{ux} = $q_{max,u}$*L_y*((Bx-b)/2)²/2	Ton-cm	471.94	889.28	1,005.99	1,005.99	1,070.14	1,070.14	912.90	912.90	984.22	984.22	278.59	278.59	278.59	278.59	278.59	278.59	278.59
K_x = M_{ux}/(L_y*d²)	Ton/cm²	0.00440	0.00715	0.01077	0.01077	0.01140	0.01140	0.00975	0.00975	0.01051	0.01051	0.00297	0.00297	0.00297	0.00297	0.00297	0.00297	0.00297
ρ_x = (0.85*f'_c/f_y)*(1-(1-(2.6222*K_x/f'_c))^{0.5}) > 0.0018	-	0.00118	0.00194	0.00296	0.00296	0.00315	0.00315	0.00267	0.00267	0.00289	0.00289	0.00080	0.00080	0.00080	0.00080	0.00080	0.00080	0.00080
A_{sx} = ρ_x*L_y*d	cm²	7.49	8.08	12.33	12.33	13.11	13.11	11.12	11.12	12.02	12.02	7.49	7.49	7.49	7.49	7.49	7.49	7.49
Longitud de varilla = Bx - 10	cm	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00
DIRECCION Y																		
M_{uy} = $q_{max,u}$*B_x*((Ly-h)/2)²/2	Ton-cm	612.35	487.44	749.54	749.54	796.29	796.29	675.46	675.46	721.81	721.81	207.04	207.04	207.04	207.04	207.04	207.04	207.04
K_y = M_{uy}/(B_x*d²)	Ton/cm²	0.00654	0.00521	0.00801	0.00801	0.00849	0.00849	0.00724	0.00724	0.00781	0.00781	0.00221	0.00221	0.00221	0.00221	0.00221	0.00221	0.00221
ρ_y = (0.85*f'_c/f_y)*(1-(1-(2.6222*K_y/f'_c))^{0.5}) > 0.0018	-	0.00187	0.00151	0.00231	0.00231	0.00245	0.00245	0.00208	0.00208	0.00225	0.00225	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060
A_{sy} = ρ_y*B_x*d	cm²	7.49	8.08	12.33	12.33	13.11	13.11	11.12	11.12	12.02	12.02	7.49	7.49	7.49	7.49	7.49	7.49	7.49
Longitud de varilla = Ly - 10	cm	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	13.11
A_{sy} Máximo	cm²	13.11
EN SENTIDO X USAR	-	11 VARILLAS No. 4 L = 1.75 m. @ 17.5 cm.
EN SENTIDO Y USAR	-	11 VARILLAS No. 4 L = 1.75 m. @ 17.5 cm.

7.4 DISEÑO DE VIGAS Y COLUMNAS

7.4.1 VIGAS

V-110/N+3.45

B=0.40 H=0.45 L=4.87			B=0.40 H=0.45 L=4.87			B=0.40 H=0.45 L=4.87		
Mu=-16.27 As =9.66 As(r)=5.23		Mu=-26.11 As =9.66 As(r)=5.23	Mu=-19.05 As =9.66 As(r)=5.23		Mu=-20.90 As =9.66 As(r)=5.23	Mu=-16.32 As =9.66 As(r)=5.23		Mu=-34.04 As =9.66 As(r)=5.23
	Mu=8.87 As =6.50 As(r)=5.23			Mu=7.18 As =6.50 As(r)=5.23			Mu=8.51 As =6.50 As(r)=5.23	
Vu=-15.53	Vu=6.32	Vu=19.98	Vu=-16.40	Vu=3.43	Vu=17.09	Vu=-14.62	Vu=7.05	Vu=20.71

B=0.40 H=0.45 L=1.90		
Mu=-36.95 As =9.66 As(r)=5.23		Mu=-0.84 As =9.66 As(r)=5.23
	Mu=0.00 As =6.50 As(r)=5.23	
Vu=-23.06	Vu=-16.41	Vu=-9.76

V-111/N+3.45

B=0.40 H=0.45 L=4.87			B=0.40 H=0.45 L=4.87			B=0.40 H=0.45 L=4.87		
Mu=-14.89 As =9.66 As(r)=5.23		Mu=-25.20 As =9.66 As(r)=5.23	Mu=-18.26 As =9.66 As(r)=5.23		Mu=-18.92 As =9.66 As(r)=5.23	Mu=-11.66 As =9.66 As(r)=5.23		Mu=-42.36 As =9.66 As(r)=5.23
	Mu=8.76 As =6.50 As(r)=5.23			Mu=7.60 As =6.50 As(r)=5.23			Mu=10.59 As =6.50 As(r)=5.23	
Vu=-15.01	Vu=5.91	Vu=19.57	Vu=-16.23	Vu=2.82	Vu=16.48	Vu=-11.79	Vu=9.13	Vu=22.79

B=0.40 H=0.45 L=1.90		
Mu=-69.32 As =9.66 As(r)=5.23		Mu=-0.00 As =9.66 As(r)=5.23
	Mu=0.00 As =6.50 As(r)=5.23	
Vu=-38.65	Vu=-32.00	Vu=-25.35

V-112/N+3.45

B=0.40 H=0.45 L=4.87			B=0.40 H=0.45 L=4.87			B=0.40 H=0.45 L=4.87		
Mu=-18.64 As =9.66 As(r)=5.23		Mu=-28.69 As =9.66 As(r)=5.23	Mu=-20.97 As =9.66 As(r)=5.23		Mu=-22.19 As =9.66 As(r)=5.23	Mu=-16.21 As =9.66 As(r)=5.23		Mu=-42.86 As =9.66 As(r)=5.23
	Mu=8.86 As =6.50 As(r)=5.23			Mu=7.77 As =6.50 As(r)=5.23			Mu=10.71 As =6.50 As(r)=5.23	
Vu=-16.34	Vu=7.38	Vu=21.04	Vu=-17.22	Vu=4.01	Vu=17.67	Vu=-13.97	Vu=9.61	Vu=23.27

B=0.40 H=0.45 L=1.90		
Mu=-56.00 As =9.66 As(r)=5.23		Mu=-0.24 As =9.66 As(r)=5.23
	Mu=0.00 As =6.50 As(r)=5.23	
Vu=-32.24	Vu=-25.59	Vu=-18.93

V-113/N+3.45

B=0.40 H=0.45 L=7.79			B=0.40 H=0.45 L=6.64		
Mu=-35.51 As =9.66 As(r)=5.23		Mu=-39.91 As =9.66 As(r)=5.23	Mu=-34.43 As =9.66 As(r)=5.23		Mu=-27.95 As =9.66 As(r)=5.23
	Mu=19.30 As =7.92 As(r)=5.23			Mu=13.86 As =7.92 As(r)=5.23	
Vu=-24.63	Vu=2.64	Vu=30.58	Vu=-23.03	Vu=-3.53	Vu=20.74

V-114/N+3.45

B=0.40 H=0.45 L=7.79			B=0.40 H=0.45 L=6.64		
Mu=-37.37 As =9.66 As(r)=5.23		Mu=-40.06 As =9.66 As(r)=5.23	Mu=-34.56 As =9.66 As(r)=5.23		Mu=-26.66 As =9.66 As(r)=5.23
	Mu=19.37 As =7.92 As(r)=5.23			Mu=13.77 As =7.92 As(r)=5.23	
Vu=-24.67	Vu=3.10	Vu=34.40	Vu=-23.01	Vu=-3.50	Vu=20.76

V-115/N+3.45

B=0.40 H=0.45 L=7.79			B=0.40 H=0.45 L=6.64		
Mu=-37.08 As =9.66 As(r)=5.23		Mu=-41.51 As =9.66 As(r)=5.23	Mu=-34.69 As =9.66 As(r)=5.23		Mu=-28.57 As =9.66 As(r)=5.23
	Mu=19.38 As =7.92 As(r)=5.23			Mu=13.77 As =7.92 As(r)=5.23	
Vu=-24.63	Vu=3.13	Vu=34.70	Vu=-22.98	Vu=-3.60	Vu=20.79

V-116/N+3.45

B=0.40 H=0.45 L=7.79			B=0.40 H=0.45 L=6.64		
Mu=-37.41 As =9.66 As(r)=5.23		Mu=-43.08 As =9.66 As(r)=5.23	Mu=-37.87 As =9.66 As(r)=5.23		Mu=-30.74 As =9.66 As(r)=5.23
	Mu=19.52 As =7.92 As(r)=5.23			Mu=14.08 As =7.92 As(r)=5.23	
Vu=-24.48	Vu=3.38	Vu=30.97	Vu=-23.35	Vu=-4.59	Vu=21.04

V-117/N+3.45

B=0.20 H=0.45 L=6.83			B=0.20 H=0.45 L=7.99		
Mu=-8.86 As =2.54 As(r)=2.61		Mu=-15.64 As =2.54 As(r)=2.61	Mu=-17.64 As =2.54 As(r)=2.61		Mu=-13.94 As =2.54 As(r)=2.61
	Mu=8.32 As =2.59 As(r)=2.61			Mu=11.36 As =2.59 As(r)=2.61	
Vu=-9.76	Vu=1.62	Vu=12.09	Vu=-13.25	Vu=-1.03	Vu=12.13

Columnas C-1, A-1

Nivel	H Libre	Losa	B	H	M1	M2	P	V1	V2	Cuantia	m/mr	Col/Vig Eje ppal	Col/vig Eje sec
N+3.45					18.99	29.53				12/#5 (1.0%)	0.16	1.32	2.08
	3.05	.45	.60	.40			-57.17	11.72	19.83				
		1.50			-12.84	-37.27				12/#5 (1.0%)	0.17		

Columna C-2

Nivel	H Libre	Losa	B	H	M1	M2	P	V1	V2	Cuantia	m/mr	Col/Vig Eje ppal	Col/vig Eje sec
N+3.45					-27.47	21.90				12/#7 #6 (1.7%)	0.12	1.23	3.23
	3.05	.45	.60	.40			-84.42	17.48	17.40				
		1.50			33.72	0.71				12/#7 #6 (1.7%)	0.14		

Columnas C-3, B-2, B-3, A-3, A-4

Nivel	H Libre	Losa	B	H	M1	M2	P	V1	V2	Cuantia	m/mr	Col/Vig Eje ppal	Col/vig Eje sec
N+3.45					-29.81	20.49				14/#6 (1.7%)	0.13	1.22	3.23
	3.05	.45	.60	.40			-78.94	18.48	19.19				
		1.50			34.86	6.76				14/#6 (1.7%)	0.14		

Columnas C-4, B-4

Nivel	H Libre	Losa	B	H	M1	M2	P	V1	V2	Cuantia	m/mr	Col/Vig Eje ppal	Col/vig Eje sec
N+3.45					34.72	37.83				16/#6 #5 (1.6%)	0.17	1.21	3.15
	3.05	.45	.60	.40			-92.69	18.40	25.88				
		1.50			-29.68	-42.04				16/#6 #5 (1.6%)	0.16		

Columna B-1

Nivel	H Libre	Losa	B	H	M1	M2	P	V1	V2	Cuantia	m/mr	Col/Vig Eje ppal	Col/vig Eje sec
N+3.45					-3.69	-23.28				16/#4 #5 (1.1%)	0.09	1.44	1.23
	3.05	.45	.60	.40			-85.18	9.14	16.01				
		1.50			13.70	32.74				16/#4 #5 (1.1%)	0.14		

Columna A-2

Nivel	H Libre	Losa	B	H	M1	M2	P	V1	V2	Cuantia	m/mr	Col/Vig Eje ppal	Col/vig Eje sec
N+3.45					-23.10	-22.48				12/#6 #7 (1.7%)	0.11	1.23	3.17
	3.05	.45	.60	.40			-80.89	14.65	14.62				
		1.50			28.17	28.72				12/#6 #7 (1.7%)	0.14		

7.4.2 DISEÑO DE ELEMENTOS METALICOS

Design Data 07/03/2017

1 Design Data

This chapter provides design data and results.

1.1 Steel Frame Design

Table 1.1 - Steel Frame Preferences - AISC 360-10

Item	Value
Multi-Response Design	Step-by-Step
Frame Type	OMF
Seismic Design Grade	D
Importance Factor	1
Design System Rho	0
Design System Sds	1
Design System R	8
Design System Omega0	3
Design System Cd	5.5
Design Provision	LRFD
Analysis Method	Direct Analysis
Second Order Method	General 2nd Order
Stiffness Reduction Method	Tau-b Fixed
Phi (Bending)	0.9
Phi (Compression)	0.9
Phi (Tension-Yielding)	0.9
Phi (Tension-Fracture)	0.75
Phi (Shear)	0.9
Phi (Shear-Short Webbed Rolled I)	1
Phi (Torsion)	0.9
Ignore Seismic Code?	No
Ignore Special Seismic Load?	No
Doubler Plate Plug-Welded?	Yes
HSS Welding Type	ERW
Reduced HSS Thickness	No
Consider Deflection?	Yes
DL Ratio	120
SDL+LL Ratio	120
LL Ratio	360
Total Ratio	240
Total Camber Limit	240
Pattern Live Load Factor	0.75
D/C Ratio Limit	0.95

Table 1.2 - Steel Column Envelope

Label	Story	Section	Moment Interaction Check	PMM Combo	V22 Ratio	V33 Ratio	Class	Cont. Plate cm²	Dbl. Plate mm	B/C Ratio Major	B/C Ratio Minor
C42	N+5.34	PERFILCOL	0.152 = 1.372E-04 + 0.005 + 0.147	COMDIS11	0.009	0.016	Slender				
C44	N+5.34	PERFILCOL	0.263 = 1.233E-04 + 0.004 + 0.259	COMDIS11	0.011	0.028	Slender				
C45	N+5.34	PERFILCOL	0.263 = 0.001 + 0.002 + 0.26	COMDIS11	0.011	0.028	Slender				
C46	N+5.34	PERFILCOL	0.152 = 4.23E-04 + 0.005 + 0.147	COMDIS11	0.009	0.016	Slender				
C42	N+3.95	PERFILCOL	0.121 = 0.003 + 0.09 + 0.028	COMDIS3	0.009	0.016	Slender	-39	-150	0	0
C44	N+3.95	PERFILCOL	0.139 = 0.005 + 0.097 + 0.037	COMDIS3	0.011	0.028	Slender	-39	-150	0	0
C19-1	N+3.95	PERFILCOL	0.193 = 0.014 + 0.002 + 0.178	COMDIS8	0.005	0.043	Slender				
C45	N+3.95	PERFILCOL	0.141 = 0.005 + 0.099 + 0.038	COMDIS3	0.011	0.028	Slender	-39	-150	0	0
C22-2	N+3.95	PERFILCOL	0.193 = 0.014 + 0.002 + 0.177	COMDIS8	0.005	0.041	Slender				

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Label	Story	Section	Moment Interaction Check	PMM Combo	V22 Ratio	V33 Ratio	Class	Cont. Plate cm²	Dbl. Plate mm	B/C Ratio Major	B/C Ratio Minor
C24-2	N+3.95	PERFILCOL	0.183 = 0.011 + 0.002 + 0.17	COMDIS11	0.005	0.033	Slender				
C46	N+3.95	PERFILCOL	0.128 = 0.003 + 0.097 + 0.028	COMDIS3	0.009	0.016	Slender	-39	-150	0	0
C25-1	N+3.95	PERFILCOL	0.115 = 0.008 + 0.006 + 0.101	COMDIS8	0.004	0.026	Slender				
C27-1	N+3.95	PERFILCOL	0.107 = 0.007 + 0.004 + 0.096	COMDIS11	0.003	0.025	Slender				
C21-2	N+3.95	PERFILCOL	0.172 = 0.007 + 0.002 + 0.164	COMDIS9	0.004	0.032	Slender				
C21-4	N+3.95	PERFILCOL	0.182 = 0.011 + 0.002 + 0.17	COMDIS11	0.004	0.032	Slender				
C18-1	N+3.95	PERFILCOL	0.114 = 0.008 + 0.005 + 0.101	COMDIS8	0.004	0.027	Slender				
C16-2	N+3.95	PERFILCOL	0.103 = 0.002 + 0.001 + 0.099	COMDIS8	0.003	0.021	Slender				
C16-3	N+3.95	PERFILCOL	0.106 = 0.006 + 0.004 + 0.096	COMDIS11	0.003	0.021	Slender				

Table 1.3 - Steel Beam Envelope

Label	Story	Section	Moment Interaction Check	PMM Combo	V22 Ratio	V33 Ratio	Class	Conn. V I-End kN	Conn. V J-End kN
B85	N+5.93	180X65X4	0.054 = 0.001 + 0.013 + 0.04	COMDIS3	0.002	0.003	Seismic MD	-0.8638	0.9571
B86	N+5.93	180X65X4	0.045 = 1.776E-04 + 0.016 + 0.029	COMDIS3	0.002	0.002	Seismic MD	-0.7844	0.7904
B87	N+5.93	180X65X4	0.054 = 0.001 + 0.013 + 0.04	COMDIS3	0.002	0.003	Seismic MD	-0.9534	0
B77	N+5.34	180X65X4	0.035 = 0 + 0.033 + 0.002	COMDIS8	0.002	0.0004357	Seismic MD	0	0
B78	N+5.34	180X65X4	0.044 = 0 + 0.038 + 0.006	COMDIS9	0.003	0.001	Seismic MD	0	0
B79	N+5.34	180X65X4	0.091 = 0.004 + 0.063 + 0.024	COMDIS3	0.004	0.002	Seismic MD	-2.5429	2.688
B80	N+5.34	180X65X4	0.082 = 0.001 + 0.058 + 0.023	COMDIS3	0.004	0.002	Seismic MD	-2.2412	2.3451
B81	N+5.34	180X65X4	0.086 = 0.001 + 0.059 + 0.026	COMDIS3	0.004	0.002	Seismic MD	-2.6521	2.5835
B88	N+5.34	180X65X4	0.035 = 0 + 0.032 + 0.003	COMDIS11	0.002	0.0003757	Seismic MD	0	0
B89	N+5.34	180X65X4	0.044 = 0 + 0.038 + 0.006	COMDIS11	0.003	0.0004495	Seismic MD	0	0
B90	N+5.34	180X65X4	0.043 = 0 + 0.038 + 0.005	COMDIS9	0.003	0.001	Seismic MD	0	0
B91	N+5.34	180X65X4	0.043 = 0 + 0.038 + 0.005	COMDIS11	0.003	0.0004805	Seismic MD	0	0
B21	N+3.45	180X65X4	0.018 = 0 + 0.018 + 0	DSS812	0.002	0	Seismic MD	0	0
B22	N+3.45	180X65X4	0.017 = 0 + 0.017 + 0	DSS812	0.002	0	Seismic MD	0	0
B23	N+3.45	180X65X4	0.026 = 0 + 0.026 + 0	COMDIS3	0.002	0	Seismic MD	0	0
B24	N+3.45	180X65X4	0.025 = 0 + 0.025 + 0	COMDIS8	0.002	0	Seismic MD	0	0.7015
B25	N+3.45	180X65X4	0.039 = 0 + 0.039 + 0	COMDIS8	0.003	0	Seismic MD	0	1.0122
B26	N+3.45	180X65X4	0.036 = 0 + 0.036 + 0	COMDIS8	0.003	0	Seismic MD	0	1.0734
B27	N+3.45	180X65X4	0.025 = 0 + 0.025 + 0	COMDIS8	0.002	0	Seismic MD	0	0.7626
B71	N+3.45	180X65X4	0.026 = 0 + 0.026 + 0	COMDIS8	0.002	0	Seismic MD	0	0
B82	N+3.45	180X65X4	0.047 = 0.001 + 0.017 + 0.03	COMDIS3	0.002	0.002	Seismic MD	0	0
B83	N+3.45	180X65X4	0.042 = 0 + 0.016 + 0.027	COMDIS3	0.002	0.002	Seismic MD	0	0
B84	N+3.45	180X65X4	0.046 = 0.001 + 0.015 + 0.03	COMDIS3	0.002	0.002	Seismic MD	0	0
B92	N+3.45	180X65X4	0.062 = 0.006 + 0.013 + 0.043	COMDIS3	0.002	0.005	Seismic MD	-0.6034	0
B93	N+3.45	180X65X4	0.08 = 0.012 + 0.019 + 0.049	COMDIS3	0.003	0.006	Seismic MD	-0.8886	0
B94	N+3.45	180X65X4	0.081 = 0.012 + 0.02 + 0.049	COMDIS3	0.003	0.006	Seismic MD	-0.9468	0
B95	N+3.45	180X65X4	0.064 = 0.006 + 0.014 + 0.043	COMDIS3	0.002	0.005	Seismic MD	-0.6358	0

Table 1.4 - Steel Brace Envelope

Label	Story	Section	Moment Interaction Check	PMM Combo	V22 Ratio	V33 Ratio	Class	Conn. P I-End kN	Conn. P J-End kN

Label	Story	Section	Moment Interaction Check	PMM Combo	V22 Ratio	V33 Ratio	Class	Conn. P I-End kN	Conn. P J-End kN
D117	N+5.93	180X65X4	0.248 = 0.001 + 0.247 + 2.035E-04	COMDIS8	0.023	0.009	Seismic MD	-1.0332	-0.6509
D124	N+5.93	180X65X4	0.443 = 0.002 + 0.441 + 0.001	COMDIS8	0.043	0.011	Seismic MD	-2.041	-1.4426
D130	N+5.93	180X65X4	0.444 = 0.002 + 0.441 + 0.001	COMDIS8	0.043	0.011	Seismic MD	-2.1007	-1.5024
D136	N+5.93	180X65X4	0.248 = 0.001 + 0.247 + 1.582E-04	COMDIS8	0.023	0.009	Seismic MD	-1.0898	-0.7075
D123	N+5.34	180X65X4	0.677 = 0.019 + 0.657 + 4.258E-04	COMDIS8	0.065	0.01	Seismic MD	-7.2336	-5.3966
D128	N+5.34	180X65X4	0.59 = 0.001 + 0.588 + 4.644E-04	COMDIS11	0.059	0.007	Seismic MD	-10.3831	-6.9992
D129	N+5.34	180X65X4	0.674 = 0.016 + 0.658 + 4.096E-04	COMDIS8	0.065	0.01	Seismic MD	-6.2146	-4.3458
D134	N+5.34	180X65X4	0.338 = 0.001 + 0.335 + 0.002	COMDIS11	0.033	0.007	Seismic MD	-8.4754	-6.2383
D135	N+5.34	180X65X4	0.39 = 0.016 + 0.373 + 0.001	COMDIS8	0.037	0.01	Seismic MD	-5.6805	-4.4577
D174	N+5.34	180X65X4	0.474 = 0.002 + 0.472 + 2.877E-04	COMDIS11	0.065	0.006	Seismic MD	-10.0448	-9.2305
D178	N+5.34	180X65X4	0.591 = 0.003 + 0.588 + 4.252E-04	COMDIS11	0.059	0.007	Seismic MD	-8.8849	-8.0705
D179	N+5.34	180X65X4	0.39 = 0.017 + 0.373 + 0	COMDIS8	0.037	0.01	Seismic MD	-5.905	-4.686
D184	N+5.34	180X65X4	0.267 = 0 + 0.266 + 0.001	COMDIS11	0.031	0.006	Seismic MD	-7.4467	-6.9263
D185	N+5.34	180X65X4	0.337 = 0.001 + 0.336 + 0.001	COMDIS11	0.033	0.007	Seismic MD	-6.8489	-6.3285
D125	N+3.95	180X65X4	0.176 = 0.017 + 0.158 + 2.827E-04	COMDIS8	0.028	0.005	Seismic MD	19.0301	19.447
D126	N+3.95	180X65X4	0.71 = 0.015 + 0.695 + 0.001	COMDIS8	0.068	0.014	Seismic MD	-5.1534	-5.1381
D131	N+3.95	180X65X4	0.176 = 0.017 + 0.159 + 0.001	COMDIS8	0.028	0.005	Seismic MD	19.0375	19.4543
D132	N+3.95	180X65X4	0.708 = 0.012 + 0.694 + 0.002	COMDIS8	0.067	0.014	Seismic MD	-6.0324	-6.0284
D133	N+3.95	180X65X4	0.634 = 0.001 + 0.631 + 0.002	COMDIS11	0.06	0.014	Seismic MD	14.2349	-10.9171
D137	N+3.95	180X65X4	0.097 = 0.009 + 0.088 + 4.399E-04	COMDIS8	0.016	0.004	Seismic MD	10.1261	10.3925
D138	N+3.95	180X65X4	0.409 = 0.013 + 0.393 + 0.003	COMDIS8	0.039	0.012	Seismic MD	-4.4474	-4.4433
D139	N+3.95	180X65X4	0.359 = 0.001 + 0.357 + 0.001	COMDIS11	0.034	0.01	Seismic MD	5.9501	-8.9099
D171	N+3.95	180X65X4	0.132 = 0.013 + 0.118 + 4.622E-04	COMDIS11	0.023	0.001	Seismic MD	15.1136	15.2816
D173	N+3.95	180X65X4	0.633 = 0.002 + 0.631 + 3.167E-04	COMDIS11	0.06	0.013	Seismic MD	-10.1179	-10.0448
D180	N+3.95	180X65X4	0.097 = 0.009 + 0.088 + 0	COMDIS8	0.016	0.004	Seismic MD	10.0665	10.3328
D181	N+3.95	180X65X4	0.411 = 0.014 + 0.394 + 0.004	COMDIS8	0.039	0.012	Seismic MD	-4.6757	-4.666
D182	N+3.95	180X65X4	0.073 = 0.007 + 0.066 + 2.198E-04	COMDIS11	0.013	0.001	Seismic MD	7.7415	7.8609
D183	N+3.95	180X65X4	0.356 = 0 + 0.355 + 0.001	COMDIS11	0.034	0.009	Seismic MD	-7.5381	-7.4914

Table 1.5 - Steel Frame Summary - AISC 360-10 (Part 1 of 2)

Story	Label	Unique Name	Design Type	Design Section	Status	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio
N+5.34	C42	87	Column	PERFILCOL	No Message	COMDIS9(C)	0.129	0.002	0.006	0.12
N+5.34	C42		Column	PERFILCOL	No Message	COMDIS11(T)	0.152	0.0001372	0.005	0.147
N+5.34	C44	41	Column	PERFILCOL	No Message	COMDIS9(C)	0.22	0.005	0.003	0.213
N+5.34	C44		Column	PERFILCOL	No Message	COMDIS11(T)	0.263	0.0001233	0.004	0.259
N+5.34	C45	49	Column	PERFILCOL	No Message	COMDIS9(C)	0.221	0.005	0.003	0.213
N+5.34	C45		Column	PERFILCOL	No Message	COMDIS11(T)	0.263	0.001	0.002	0.26
N+5.34	C46	60	Column	PERFILCOL	No Message	COMDIS9(C)	0.128	0.002	0.006	0.12
N+5.34	C46		Column	PERFILCOL	No Message	COMDIS11(T)	0.152	0.000423	0.005	0.147

Story	Label	Unique Name	Design Type	Design Section	Status	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio
N+3.95	C42	86	Column	PERFILCOL	No Message	COMDIS3(C)	0.121	0.003	0.09	0.028
N+3.95	C44	40	Column	PERFILCOL	No Message	COMDIS3(C)	0.139	0.005	0.097	0.037
N+3.95	C19-1	44	Column	PERFILCOL	No Message	COMDIS8(C)	0.193	0.014	0.002	0.178
N+3.95	C19-1		Column	PERFILCOL	No Message	COMDIS11(T)	0.137	0.008	0.002	0.127
N+3.95	C45	48	Column	PERFILCOL	No Message	COMDIS3(C)	0.141	0.005	0.099	0.038
N+3.95	C45		Column	PERFILCOL	No Message	COMDIS11(T)	0.136	0.0002828	0.005	0.133
N+3.95	C22-2	53	Column	PERFILCOL	No Message	COMDIS8(C)	0.193	0.014	0.002	0.177
N+3.95	C22-2		Column	PERFILCOL	No Message	COMDIS11(T)	0.136	0.008	0.002	0.126
N+3.95	C24-2	56	Column	PERFILCOL	No Message	COMDIS11(C)	0.183	0.011	0.002	0.17
N+3.95	C24-2		Column	PERFILCOL	No Message	COMDIS9(T)	0.163	0.007	0.002	0.155
N+3.95	C46	59	Column	PERFILCOL	No Message	COMDIS3(C)	0.128	0.003	0.097	0.028
N+3.95	C46		Column	PERFILCOL	No Message	COMDIS11(T)	0.091	0	0.011	0.08
N+3.95	C25-1	64	Column	PERFILCOL	No Message	COMDIS8(C)	0.115	0.008	0.006	0.101
N+3.95	C25-1		Column	PERFILCOL	No Message	COMDIS11(T)	0.075	0.004	0.001	0.07
N+3.95	C27-1	67	Column	PERFILCOL	No Message	COMDIS11(C)	0.107	0.007	0.004	0.096
N+3.95	C27-1		Column	PERFILCOL	No Message	COMDIS8(T)	0.1	0.002	0.0002635	0.097
N+3.95	C21-2	79	Column	PERFILCOL	No Message	COMDIS11(C)	0.166	0.011	0.002	0.153
N+3.95	C21-2		Column	PERFILCOL	No Message	COMDIS9(T)	0.172	0.007	0.002	0.164
N+3.95	C21-4	81	Column	PERFILCOL	No Message	COMDIS11(C)	0.182	0.011	0.002	0.17
N+3.95	C21-4		Column	PERFILCOL	No Message	COMDIS9(T)	0.155	0.007	0.002	0.147
N+3.95	C18-1	90	Column	PERFILCOL	No Message	COMDIS8(C)	0.114	0.008	0.005	0.101
N+3.95	C18-1		Column	PERFILCOL	No Message	COMDIS11(T)	0.077	0.004	0.002	0.07
N+3.95	C16-2	93	Column	PERFILCOL	No Message	COMDIS11(C)	0.095	0.006	0.004	0.085
N+3.95	C16-2		Column	PERFILCOL	No Message	COMDIS8(T)	0.103	0.002	0.001	0.099
N+3.95	C16-3	95	Column	PERFILCOL	No Message	COMDIS11(C)	0.106	0.006	0.004	0.096
N+3.95	C16-3		Column	PERFILCOL	No Message	COMDIS9(T)	0.089	0.003	0.002	0.084
N+5.93	B85	100	Beam	180X65X4	No Message	COMDIS3(C)	0.054	0.001	0.013	0.04
N+5.93	B86	75	Beam	180X65X4	No Message	COMDIS3(C)	0.045	0.0001776	0.016	0.029
N+5.93	B86		Beam	180X65X4	No Message	COMDIS9(T)	0.005	0	0.004	0.001
N+5.93	B87	76	Beam	180X65X4	No Message	COMDIS3(C)	0.054	0.001	0.013	0.04
N+5.34	B77	69	Beam	180X65X4	No Message	COMDIS3(C)	0.019	0.001	0.012	0.006
N+5.34	B77		Beam	180X65X4	No Message	COMDIS8(T)	0.035	0	0.033	0.002
N+5.34	B78	70	Beam	180X65X4	No Message	COMDIS3(C)	0.02	0.002	0.01	0.007
N+5.34	B78		Beam	180X65X4	No Message	COMDIS9(T)	0.044	0	0.038	0.006
N+5.34	B79	104	Beam	180X65X4	No Message	COMDIS3(C)	0.091	0.004	0.063	0.024
N+5.34	B80	71	Beam	180X65X4	No Message	COMDIS3(C)	0.082	0.001	0.058	0.023
N+5.34	B81	72	Beam	180X65X4	No Message	COMDIS3(C)	0.086	0.001	0.059	0.026

Story	Label	Unique Name	Design Type	Design Section	Status	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio
N+5.34	B81		Beam	180X65X4	No Message	DStlS12(T)	0.015	0.0001095	0.014	0.0003094
N+5.34	B88	77	Beam	180X65X4	No Message	COMDIS9(C)	0.019	0	0.016	0.003
N+5.34	B88		Beam	180X65X4	No Message	COMDIS11(T)	0.035	0	0.032	0.003
N+5.34	B89	78	Beam	180X65X4	No Message	COMDIS9(C)	0.029	0	0.023	0.006
N+5.34	B89		Beam	180X65X4	No Message	COMDIS11(T)	0.044	0	0.038	0.006
N+5.34	B90	99	Beam	180X65X4	No Message	COMDIS3(C)	0.019	0.002	0.011	0.007
N+5.34	B90		Beam	180X65X4	No Message	COMDIS9(T)	0.043	0	0.038	0.005
N+5.34	B91	103	Beam	180X65X4	No Message	COMDIS9(C)	0.029	0	0.022	0.006
N+5.34	B91		Beam	180X65X4	No Message	COMDIS11(T)	0.043	0	0.038	0.005
N+3.45	B21	102	Beam	180X65X4	No Message	DStlS12(C)	0.018	0	0.018	0
N+3.45	B22	18	Beam	180X65X4	No Message	DStlS12(C)	0.017	0	0.017	0
N+3.45	B23	19	Beam	180X65X4	No Message	COMDIS3(C)	0.026	0	0.026	0
N+3.45	B24	85	Beam	180X65X4	No Message	COMDIS8(C)	0.025	0	0.025	0
N+3.45	B25	20	Beam	180X65X4	No Message	COMDIS8(C)	0.039	0	0.039	0
N+3.45	B26	47	Beam	180X65X4	No Message	COMDIS8(C)	0.036	0	0.036	0
N+3.45	B27	58	Beam	180X65X4	No Message	COMDIS8(C)	0.025	0	0.025	0
N+3.45	B71	39	Beam	180X65X4	No Message	COMDIS8(C)	0.026	0	0.026	0
N+3.45	B82	101	Beam	180X65X4	No Message	COMDIS3(C)	0.047	0.001	0.017	0.03
N+3.45	B82		Beam	180X65X4	No Message	DStlS1(T)	0.017	0	0.017	0
N+3.45	B83	73	Beam	180X65X4	No Message	COMDIS8(C)	0.014	0	0.014	0.0001025
N+3.45	B83		Beam	180X65X4	No Message	COMDIS3(T)	0.042	0	0.016	0.027
N+3.45	B84	74	Beam	180X65X4	No Message	COMDIS3(C)	0.046	0.001	0.016	0.03
N+3.45	B84		Beam	180X65X4	No Message	DStlS1(T)	0.016	0	0.016	0
N+3.45	B92	105	Beam	180X65X4	No Message	COMDIS3(C)	0.062	0.006	0.013	0.043
N+3.45	B92		Beam	180X65X4	No Message	DStlS4(T)	0.012	0.001	0.011	0.0001504
N+3.45	B93	106	Beam	180X65X4	No Message	COMDIS3(C)	0.08	0.012	0.019	0.049
N+3.45	B93		Beam	180X65X4	No Message	COMDIS11(T)	0.022	0.008	0.014	0.0001678
N+3.45	B94	107	Beam	180X65X4	No Message	COMDIS3(C)	0.081	0.012	0.02	0.049
N+3.45	B94		Beam	180X65X4	No Message	COMDIS11(T)	0.021	0.008	0.013	0
N+3.45	B95	108	Beam	180X65X4	No Message	COMDIS3(C)	0.064	0.006	0.014	0.043
N+3.45	B95		Beam	180X65X4	No Message	DStlS4(T)	0.014	0.001	0.013	0.001
N+5.93	D117	89	Brace	180X65X4	No Message	COMDIS8(C)	0.248	0.001	0.247	0.0002035
N+5.93	D124	43	Brace	180X65X4	No Message	COMDIS8(C)	0.443	0.002	0.441	0.001
N+5.93	D130	52	Brace	180X65X4	No Message	COMDIS8(C)	0.444	0.002	0.441	0.001
N+5.93	D136	63	Brace	180X65X4	No Message	COMDIS8(C)	0.248	0.001	0.247	0.0001582
N+5.34	D123	42	Brace	180X65X4	No Message	COMDIS8(C)	0.677	0.019	0.657	0.0004258
N+5.34	D123		Brace	180X65X4	No Message	COMDIS11(T)	0.454	0.003	0.45	0.001

Story	Label	Unique Name	Design Type	Design Section	Status	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio
N+5.34	D128	50	Brace	180X65X4	No Message	COMDIS9(C)	0.469	0.02	0.449	0
N+5.34	D128		Brace	180X65X4	No Message	COMDIS11(T)	0.59	0.001	0.588	0.0004644
N+5.34	D129	51	Brace	180X65X4	No Message	COMDIS8(C)	0.674	0.016	0.658	0.0004096
N+5.34	D129		Brace	180X65X4	No Message	COMDIS11(T)	0.451	0.001	0.449	0.0002806
N+5.34	D134	61	Brace	180X65X4	No Message	COMDIS11(C)	0.338	0.001	0.335	0.002
N+5.34	D135	62	Brace	180X65X4	No Message	COMDIS8(C)	0.39	0.016	0.373	0.001
N+5.34	D135		Brace	180X65X4	No Message	COMDIS11(T)	0.248	0.0001966	0.246	0.001
N+5.34	D174	83	Brace	180X65X4	No Message	COMDIS9(C)	0.393	0.029	0.363	0.001
N+5.34	D174		Brace	180X65X4	No Message	COMDIS11(T)	0.474	0.002	0.472	0.0002877
N+5.34	D178	84	Brace	180X65X4	No Message	COMDIS9(C)	0.472	0.024	0.448	0.0004516
N+5.34	D178		Brace	180X65X4	No Message	COMDIS11(T)	0.591	0.003	0.588	0.0004252
N+5.34	D179	88	Brace	180X65X4	No Message	COMDIS8(C)	0.39	0.017	0.373	0
N+5.34	D179		Brace	180X65X4	No Message	COMDIS11(T)	0.248	0.001	0.247	0.0004044
N+5.34	D184	97	Brace	180X65X4	No Message	COMDIS9(C)	0.221	0.021	0.199	0.0003986
N+5.34	D184		Brace	180X65X4	No Message	COMDIS11(T)	0.267	0	0.266	0.001
N+5.34	D185	98	Brace	180X65X4	No Message	DStlS4(C)	0.268	0.004	0.263	0.002
N+5.34	D185		Brace	180X65X4	No Message	COMDIS11(T)	0.337	0.001	0.336	0.001
N+3.95	D125	45	Brace	180X65X4	No Message	COMDIS11(C)	0.128	0.014	0.114	0.0002398
N+3.95	D125		Brace	180X65X4	No Message	COMDIS8(T)	0.176	0.017	0.158	0.0002827
N+3.95	D126	46	Brace	180X65X4	No Message	COMDIS8(C)	0.71	0.015	0.695	0.001
N+3.95	D126		Brace	180X65X4	No Message	COMDIS11(T)	0.502	0.002	0.498	0.002
N+3.95	D131	54	Brace	180X65X4	No Message	COMDIS11(C)	0.129	0.014	0.115	0
N+3.95	D131		Brace	180X65X4	No Message	COMDIS8(T)	0.176	0.017	0.159	0.001
N+3.95	D132	55	Brace	180X65X4	No Message	COMDIS8(C)	0.709	0.012	0.694	0.002
N+3.95	D133	57	Brace	180X65X4	No Message	COMDIS9(C)	0.5	0.014	0.486	0
N+3.95	D133		Brace	180X65X4	No Message	COMDIS11(T)	0.634	0.001	0.631	0.002
N+3.95	D137	65	Brace	180X65X4	No Message	COMDIS11(C)	0.07	0.007	0.061	0.001
N+3.95	D137		Brace	180X65X4	No Message	COMDIS8(T)	0.097	0.009	0.088	0.0004399
N+3.95	D138	66	Brace	180X65X4	No Message	COMDIS8(C)	0.409	0.013	0.393	0.003
N+3.95	D139	68	Brace	180X65X4	No Message	COMDIS11(C)	0.359	0.001	0.357	0.001
N+3.95	D139		Brace	180X65X4	No Message	COMDIS11(T)	0.076	0.009	0.066	0.001
N+3.95	D171	80	Brace	180X65X4	No Message	COMDIS9(C)	0.105	0.01	0.095	0.0001499
N+3.95	D171		Brace	180X65X4	No Message	COMDIS11(T)	0.132	0.013	0.118	0.0004622
N+3.95	D173	82	Brace	180X65X4	No Message	COMDIS9(C)	0.516	0.024	0.49	0.001
N+3.95	D173		Brace	180X65X4	No Message	COMDIS11(T)	0.633	0.002	0.631	0.0003167
N+3.95	D180	91	Brace	180X65X4	No Message	COMDIS11(C)	0.069	0.007	0.061	0.001
N+3.95	D180		Brace	180X65X4	No Message	COMDIS8(T)	0.097	0.009	0.088	0

Story	Label	Unique Name	Design Type	Design Section	Status	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio
N+3.95	D181	92	Brace	180X65X4	No Message	COMDIS8(C)	0.411	0.014	0.394	0.004
N+3.95	D181		Brace	180X65X4	No Message	COMDIS11(T)	0.274	0.0004153	0.272	0.002
N+3.95	D182	94	Brace	180X65X4	No Message	COMDIS9(C)	0.058	0.005	0.051	0.001
N+3.95	D182		Brace	180X65X4	No Message	COMDIS11(T)	0.073	0.007	0.066	0.0002198
N+3.95	D183	96	Brace	180X65X4	No Message	COMDIS9(C)	0.286	0.018	0.267	0.001
N+3.95	D183		Brace	180X65X4	No Message	COMDIS11(T)	0.356	0	0.355	0.001

Table 1.5 - Steel Frame Summary - AISC 360-10 (Part 2 of 2)

Story	Label	Unique Name	V Major Combo	V Major Ratio	V Minor Combo	V Minor Ratio
N+5.34	C42	87	COMDIS3	0.009	COMDIS11	0.016
N+5.34	C42					
N+5.34	C44	41	COMDIS3	0.011	COMDIS11	0.028
N+5.34	C44					
N+5.34	C45	49	COMDIS3	0.011	COMDIS11	0.028
N+5.34	C45					
N+5.34	C46	60	COMDIS3	0.009	COMDIS11	0.016
N+5.34	C46					
N+3.95	C42	86	COMDIS3	0.009	COMDIS11	0.016
N+3.95	C44	40	COMDIS3	0.011	COMDIS11	0.028
N+3.95	C19-1	44	COMDIS3	0.005	COMDIS8	0.043
N+3.95	C19-1					
N+3.95	C45	48	COMDIS3	0.011	COMDIS11	0.028
N+3.95	C45					
N+3.95	C22-2	53	COMDIS3	0.005	COMDIS8	0.041
N+3.95	C22-2					
N+3.95	C24-2	56	COMDIS3	0.005	COMDIS4	0.033
N+3.95	C24-2					
N+3.95	C46	59	COMDIS3	0.009	COMDIS11	0.016
N+3.95	C46					
N+3.95	C25-1	64	COMDIS3	0.004	COMDIS8	0.026
N+3.95	C25-1					
N+3.95	C27-1	67	COMDIS3	0.003	COMDIS4	0.025
N+3.95	C27-1					
N+3.95	C21-2	79	COMDIS5	0.004	COMDIS4	0.032
N+3.95	C21-2					
N+3.95	C21-4	81	COMDIS5	0.004	COMDIS4	0.032
N+3.95	C21-4					
N+3.95	C18-1	90	COMDIS5	0.004	COMDIS8	0.027
N+3.95	C18-1					
N+3.95	C16-2	93	COMDIS3	0.003	COMDIS4	0.021
N+3.95	C16-2					
N+3.95	C16-3	95	COMDIS3	0.003	COMDIS4	0.021
N+3.95	C16-3					
N+5.93	B85	100	COMDIS3	0.002	COMDIS3	0.003
N+5.93	B86	75	DSIS12	0.002	COMDIS3	0.002
N+5.93	B86					
N+5.93	B87	76	COMDIS3	0.002	COMDIS3	0.003
N+5.34	B77	69	DSIS12	0.002	COMDIS3	0.0004357
N+5.34	B77					
N+5.34	B78	70	COMDIS8	0.003	COMDIS3	0.001
N+5.34	B78					
N+5.34	B79	104	COMDIS3	0.004	COMDIS3	0.002
N+5.34	B80	71	COMDIS3	0.004	COMDIS3	0.002
N+5.34	B81	72	COMDIS3	0.004	COMDIS3	0.002
N+5.34	B81					
N+5.34	B88	77	DSIS12	0.002	COMDIS3	0.0003757

Story	Label	Unique Name	V Major Combo	V Major Ratio	V Minor Combo	V Minor Ratio
N+5.34	B88					
N+5.34	B89	78	COMDIS8	0.003	COMDIS3	0.0004495
N+5.34	B89					
N+5.34	B90	99	COMDIS8	0.003	COMDIS3	0.001
N+5.34	B90					
N+5.34	B91	103	COMDIS8	0.003	COMDIS3	0.0004806
N+5.34	B91					
N+3.45	B21	102	DStlS12	0.002	DStlS18	0
N+3.45	B22	18	DStlS12	0.002	DStlS18	0
N+3.45	B23	19	DStlS12	0.002	DStlS18	0
N+3.45	B24	85	COMDIS8	0.002	DStlS18	0
N+3.45	B25	20	COMDIS8	0.003	DStlS18	0
N+3.45	B26	47	COMDIS8	0.003	DStlS18	0
N+3.45	B27	58	COMDIS8	0.002	DStlS18	0
N+3.45	B71	39	COMDIS4	0.002	DStlS18	0
N+3.45	B82	101	DStlS12	0.002	COMDIS3	0.002
N+3.45	B82					
N+3.45	B83	73	DStlS12	0.002	COMDIS3	0.002
N+3.45	B83					
N+3.45	B84	74	DStlS1	0.002	COMDIS3	0.002
N+3.45	B84					
N+3.45	B92	105	COMDIS8	0.002	COMDIS3	0.005
N+3.45	B92					
N+3.45	B93	106	COMDIS8	0.003	COMDIS3	0.006
N+3.45	B93					
N+3.45	B94	107	COMDIS8	0.003	COMDIS3	0.006
N+3.45	B94					
N+3.45	B96	108	COMDIS8	0.002	COMDIS3	0.005
N+3.45	B96					
N+5.93	D117	89	COMDIS8	0.023	COMDIS3	0.009
N+5.93	D124	43	COMDIS8	0.043	COMDIS3	0.011
N+5.93	D130	52	COMDIS8	0.043	COMDIS3	0.011
N+5.93	D136	63	COMDIS8	0.023	COMDIS3	0.009
N+5.34	D123	42	COMDIS8	0.065	COMDIS3	0.01
N+5.34	D123					
N+5.34	D128	50	COMDIS11	0.059	COMDIS5	0.007
N+5.34	D128					
N+5.34	D129	51	COMDIS8	0.065	COMDIS3	0.01
N+5.34	D129					
N+5.34	D134	61	COMDIS11	0.033	COMDIS3	0.007
N+5.34	D135	62	COMDIS8	0.037	COMDIS3	0.01
N+5.34	D135					
N+5.34	D174	83	COMDIS11	0.055	COMDIS3	0.006
N+5.34	D174					
N+5.34	D178	84	COMDIS11	0.059	COMDIS3	0.007
N+5.34	D178					
N+5.34	D179	88	COMDIS8	0.037	COMDIS3	0.01
N+5.34	D179					
N+5.34	D184	97	COMDIS11	0.031	COMDIS3	0.006
N+5.34	D184					
N+5.34	D185	98	COMDIS11	0.033	COMDIS3	0.007
N+5.34	D185					
N+3.95	D125	45	COMDIS8	0.028	COMDIS3	0.005
N+3.95	D125					
N+3.95	D126	46	COMDIS8	0.068	COMDIS3	0.014
N+3.95	D126					
N+3.95	D131	54	COMDIS8	0.028	COMDIS3	0.005
N+3.95	D131					
N+3.95	D132	55	COMDIS8	0.067	COMDIS3	0.014
N+3.95	D133	57	COMDIS11	0.06	COMDIS3	0.014

Story	Label	Unique Name	V Major Combo	V Major Ratio	V Minor Combo	V Minor Ratio
N+3.95	D133					
N+3.95	D137	65	COMDIS8	0.016	COMDIS3	0.004
N+3.95	D137					
N+3.95	D138	66	COMDIS8	0.039	COMDIS3	0.012
N+3.95	D139	68	COMDIS11	0.034	COMDIS3	0.01
N+3.95	D139					
N+3.95	D171	80	COMDIS11	0.023	COMDIS3	0.001
N+3.95	D171					
N+3.95	D173	82	COMDIS11	0.06	COMDIS3	0.013
N+3.95	D173					
N+3.95	D180	91	COMDIS8	0.016	COMDIS3	0.004
N+3.95	D180					
N+3.95	D181	92	COMDIS8	0.039	COMDIS3	0.012
N+3.95	D181					
N+3.95	D182	94	COMDIS11	0.013	COMDIS3	0.001
N+3.95	D182					
N+3.95	D183	96	COMDIS11	0.034	COMDIS3	0.009
N+3.95	D183					

7.5 DISEÑO DE ELEMNTOS COMPLEMENTARIOS

7.5.1 DISEÑO DE ELEMENTOS METÁLICOS AISC360-2010

PROYECTO: MARIA INMACULADA
DISEÑO DE UNIONES DE ELEMENTOS METÁLICOS-CONCRETO
TER

CARGAS

P=	29,58	kN
M33=	5,26	kN.m
M22=	26,11	kN.m
V22=	2,86	kN
V33=	19,25	kN

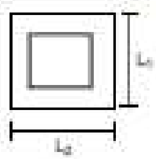
DATOS DEL PERFIL

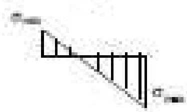
H=	0,18	m.
B=	0,07	m.

MATERIALES

f'c=	21000	kN/m^2		
fy=	252000	kN/m^2	platina	A36
fy=	735000	kN/m^2	pernos	B-7
ex=	0,178	m		

1. DIMENSIONAMIENTO EN PLANTA DE LA PLATINA





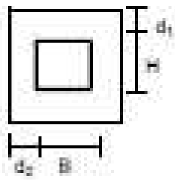
fc >= Esfuerzo sobre la platina σ_b

		L_1(asumido)=	0,23	m.
σ_b =	P / L^2 =	L_2(asumido)=	0,30	m.

σ_{min} =	-336,89 kN/m	OK.	σ_{adm} = 141,005
σ_{max} =	594,11 kN/m	OK.	

2. ESPESOR DE LA PLATINA

Datos del perfil:



H=	0,18 m
B=	0,07 m
d_1 =	0,025 m
d_2 =	0,122 m

M_1=	0,14 kN.m	V=	10,8 kN
M_2=	0,74 kN.m	V=	12,2 kN

$M_{diseño}$ = 0,74 kN.m

$e_{requerido}$ = 0,42 cm

$e_{utilizado}$ = 0,17 pulgadas

Colocar una platina de 230x295x1/2"- Acero A36

3. DISEÑO DE PERNOS

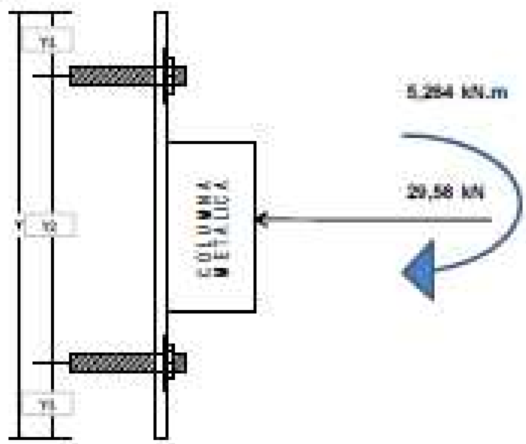
3.1. DISEÑO DE PERNOS EN SENTIDO LONGITUDINAL:

Y1= 0,040 m

Y2= 0,150 m

Y1= 0,040 m

Y= 0,23 m



Número total de anclajes: 4 Und.

CARGA POR CORTANTE:

VR = 10,46 kN

$V_{ANCLAJE}$ = VR / # total de anclajes = 4,87 kN

$V_{RESISTENTE}$ = 250,49 kN

CARGA POR COMPRESIÓN:

$P_{ANCLAJE}$ = Pu / # total de anclajes = 7,40 kN

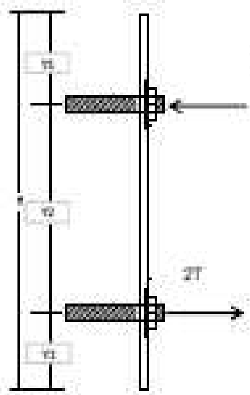
CARGA POR MOMENTO:

Y1= 0,040 m

Y2= 0,150 m

Y1= 0,040 m

Y= 0,23 m

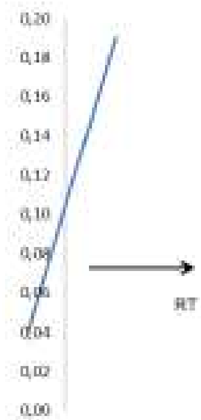


σ_{max} = 10328,60 kN/m²

e = 0,16 m

X= 0,10 m

σ_{min} = -7784,09 kN/m²



1 eje de pernos de anclaje trabajan en tensión

RT_{33} = 120,65 KN

120,65 = 2T

T_{33} = 60,33 kN

As_{33} = 0,912 cm² — *2 Pernos de 3/4"Acero B-7* 5,68 cm²

$T_{RESISTENTE\ 33}$ = 375,73 kN

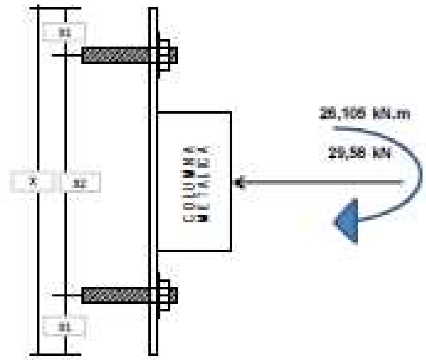
3.2. DISEÑO DE PERNOS EN SENTIDO TRANSVERSAL:

X1= 0,070 m

X2= 0,160 m

X1= 0,070 m

X= 0,30 m



Número total de anclajes: 4 Und.

CARGA POR CORTANTE:

VR = 19,46 kN

$V_{ANCLAJE}$ = VR / # total de anclajes = 4,87 kN

$V_{RESISTENTE}$ = 250,49 kN

CARGA POR COMPRESIÓN:

$P_{ANCLAJE}$ = Pu / # total de anclajes = 7,40 kN

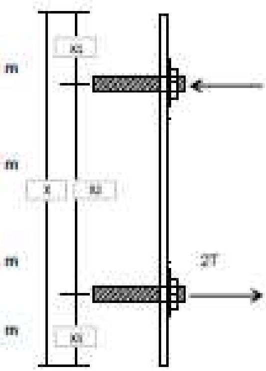
CARGA POR MOMENTO:

X1= 0,070 m

X2= 0,160 m

X1= 0,070 m

X= 0,30 m

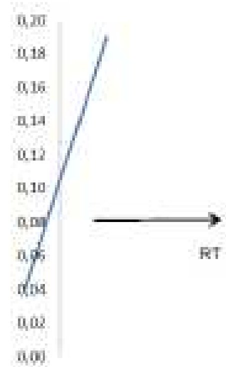


σ_{max} = 44738,32 kN/m²

a = 0,88 m

X= 0,15 m

σ_{min} = -42190,80 kN/m²



1 eje de pernos de anclaje trabajan en tensión.

$RT_{22} =$ 921,51 KN

921,51 = 2T

T_{22} = 460,75 kN

$As_{22} =$ 6,965 cm^2 *2 Pernos de 7/8"Acero B-7* 7,74 cm^2

$T_{RESISTENTE\ 22} =$ **512,00 kN**

$As_{TOTAL} =$ **13,42 cm^2** *4 Pernos de 7/8"Acero B-7* **13,42 cm^2**

$T_{RESISTENTE\ TOTAL} =$ **887,73 kN**

VERIFICACIÓN EFECTOS COMBINADOS:

T ACTUANTE TOTAL = $T_{33} + T_{22}$ = **521,08 kN**

$$(T_{ACTUANTE\ TOTAL} / T_{RESISTENTE\ TOTAL})^2 + (V_{ACTUANTE} / V_{RESISTENTE})^2 \leq 1$$

0,34 ≤ 1 OK

7.5.2 DISEÑO DE UNIONES DE ELEMENTOS METALICOS-CONCRETO TER

PROYECTO: MARIA INMACULADA
DISEÑO DE UNIONES DE ELEMENTOS METÁLICOS-CONCRETO TER

CARGAS

P=	19,40	kN
M33=	1,30	kN.m
M22=	0,76	kN.m
V22=	0,82	kN
V33=	0,48	kN

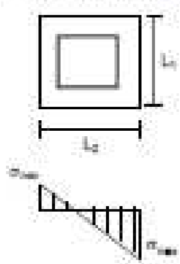
DATOS DEL PERFIL

H=	0,18	m.
B=	0,07	m.

MATERIALES

f'c=	21000	kN/m^2		
fy=	252000	kN/m^2	platina	A36
fy=	735000	kN/m^2	pernos	B-7
ex=	0,067	m		

1. DIMENSIONAMIENTO EN PLANTA DE LA PLATINA



f'c >= Esfuerzo sobre la platina σ_b

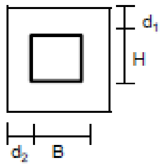
σ_b = P / L^2 =

L_1(asumido)=	0,27	m.
L_2(asumido)=	0,30	m.

σ_{min} =	-26,15 kN/m	OK.		σ_{max} =	75,200
σ_{max} =	169,86 kN/m	OK.			

2. ESPESOR DE LA PLATINA

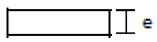
Datos del perfil:



H=	**0,18 m**
B=	**0,07 m**
d_1 =	0,045 m
d_2 =	0,122 m

M_1=	0,14 kN.m	V=	6,4 kN
M_2=	0,49 kN.m	V=	8,0 kN

$M_{diseño}$ = 0,49 kN.m



$e_{requerido}$ = **0,34 cm**

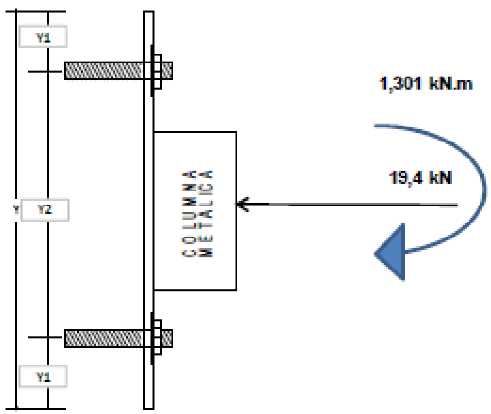
$e_{colocado}$ = **0,13 pulgadas**

Colocar una platina de 270x295x1/2"- Acero A36

3. DISEÑO DE PERNOS

3.1. DISEÑO DE PERNOS EN SENTIDO LONGITUDINAL:

Y1=	**0,070 m**
Y2=	**0,130 m**
Y1=	**0,070 m**
Y=	**0,27 m**



Número total de anclajes: **4** Und.

CARGA POR CORTANTE:

VR = 0,95 **kN**

$V_{ANCLAJE}$ = VR / # total de anclajes = **0,24 kN**

$V_{RESISTENTE}$ = **113,78 kN**

CARGA POR COMPRESIÓN:

$P_{ANCLAJE}$ = Pu / # total de anclajes = **4,85 kN**

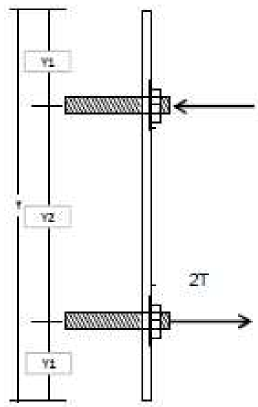
CARGA POR MOMENTO:

Y1= **0,070 m**

Y2= **0,130 m**

Y1= **0,070 m**

Y= **0,27 m**

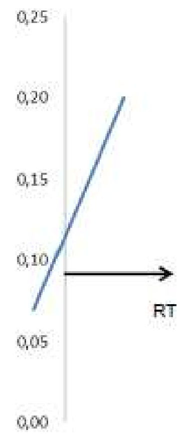


σ_{max} = **3942,74 kN/m²**

e = 0,07 m

X= 0,12 m

σ_{min} = **-2017,18 kN/m²**



1 eje de pernos de anclaje trabajan en tensión.

RT_{33} = 37,52 KN

37,52 = 2T

T_{33} = **18,76** **kN**

As_{33} = 0,284 cm^2 ***2 Pernos de 1/2"Acero B-7*** **2,58** cm^2

$T_{RESISTENTE\ 33}$ = **170,67 kN**

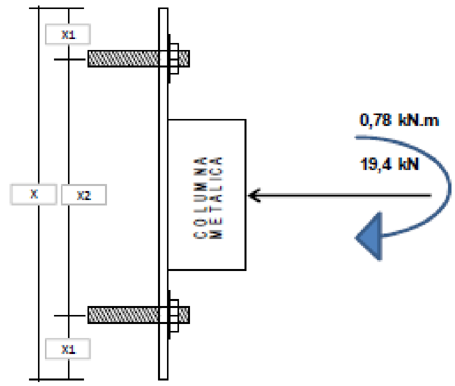
3.2. DISEÑO DE PERNOS EN SENTIDO TRANSVERSAL:

X1= 0,070 m

X2= 0,160 m

X1= 0,070 m

X= 0,30 m



Número total de anclajes: 4 Und.

CARGA POR CORTANTE:

VR = 0,95 **kN**

$V_{ANCLAJE}$ = VR / # total de anclajes = **0,24 kN**

$V_{RESISTENTE}$ = **113,78 kN**

CARGA POR COMPRESIÓN:

$P_{ANCLAJE}$ = Pu / # total de anclajes = **4,85 kN**

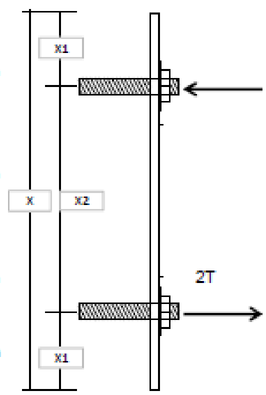
CARGA POR MOMENTO:

X1= 0,070 m

X2= 0,160 m

X1= 0,070 m

X= 0,30 m

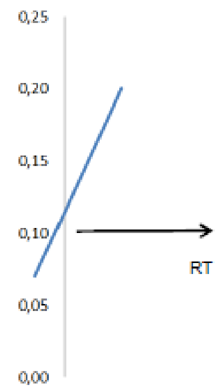


σ_{max} = **2461,22 kN/m²**

e = 0,04 m

X= 0,05 m

σ_{min} = **-535,66 kN/m²**



1 eje de pernos de anclaje trabajan en tensión.

RT_{22} = 3,73 KN

3,73 = 2T

T_{22} = **1,87** **kN**

As_{22} = 0,028 cm^2 ***2 Pernos de 1/2"Acero B-7*** 2,58 cm^2

$T_{RESISTENTE\ 22}$ = **170,67 kN**

As_{TOTAL} = **5,16 cm^2** ***4 Pernos de 1/2"Acero B-7*** **5,16 cm^2**

$T_{RESISTENTE\ TOTAL}$ = **341,33 kN**

VERIFICACIÓN EFECTOS COMBINADOS:

T ACTUANTE TOTAL = $T_{33} + T_{22}$ = **20,63 kN**

$$(T_{ACTUANTE\ TOTAL} / T_{RESISTENTE\ TOTAL})^2 + (V_{ACTUANTE} / V_{RESISTENTE})^2 \leq 1$$

0,00 ≤ **1** **OK**

7.6 DISEÑO DE ELEMENTOS NO ESTRUCTURALES

DISEÑO DE ELEMENTOS NO ESTRUCTURALES

Units: kN*m

STORY DATA

Story	*Height*	*Elevation*	*SimilarTo*
N+3.45	3,5	3,45	None
BASE	0	-0,05	None

CENTER MASS RIGIDITY

Story	Diaphragm	MassX	MassY	XCM	YCM	CumMassX	CumMassY	XCCM
N+3.45	D1	69,0327	69,0327	8,843	7,725	69,0327	69,0327	8,843

YCCM	XCR	YCR
7,725	8,022	8,004

STORY SHEARS

Story	*Load*	*Loc*	*P*	*VX*	*VY*	*T*	*MX*	*MY*
N+3.45	SISDISX	Top	0	98,67	43,8	734,046	18,457	29,901
N+3.45	SISDISX	Bottom	0	98,67	43,8	734,046	171,691	342,362
N+3.45	SISDISY	Top	0	44,23	98,63	1581,932	46,469	3,835
N+3.45	SISDISY	Bottom	0	44,23	98,63	1581,932	389,224	150,967

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

$$a_x = \frac{C_{vx} V_s}{m_x g} \leq 2S_a$$

$$C_{vx} = \frac{m_x h_x^k}{\sum_{i=1}^{n} (m_i h_i^k)}$$

$$V_s = S_a g M$$

g: 9,81 m/s^2
Sa: 0,250 m

Grupo de uso: III
Grado de desempeño: SUPERIOR

Grupo de Uso	Grado de desempeño
IV	SUPERIOR
III	SUPERIOR
II	BUENO
I	BAJO

Grado de desempeño de los elementos no estructurales: SUPERIOR

ANALISIS DE CARGAS PARA MUROS

Espesor de muros:	0,15 m
Espesor de pañete en una cara:	0 m
Densidad de mamposteria:	13 kN/m3
Densidad mortero de pañete:	21 kN/m3
Altura Fachada:	3,50 m
Carga	6,825 kN/m
Descripción:	mamposteria reforzada, separada lateralmente de la estructura, apoyada arriba y abajo
ap:	1,0
Rp:	6

ANALISIS DE CARGAS PARA ANTEPECHOS

Espesor de muros:	0,15 m
Espesor de pañete en una cara:	0 m
Densidad de mamposteria:	13 kN/m3
Densidad mortero de pañete:	21 kN/m3
Altura Antepecho:	1 m
Carga	1,95 kN/m
Descripción:	mamposteria reforzada, separada lateralmente de la estructura, apoyada solo abajo
ap:	2,5
Rp:	6

Sección de vigas verticales:	0.15x0.25 m
f'c =	21,1 MPa
fy =	420 MPa

DISEÑO PARA MUROS

Story	Fx	Wx	ax	ap	Rp	Fp	M	V
N+3.45	98,67	69,03	0,500	1,0	6	0,569	0,871	0,995
BASE	-54,44	69,03	-0,789	1,0	6	-0,897	-1,374	-1,570

	Sección Vigas V.			As. (cm2)		Separación column.		Fl. 1/4"
Story	b	d	ρ	neces.	ubicado	S max	$S_{escogida}$	$S_{estribos}$
N+3.45	0.15	0,21	0,00031	0,10	0,71	7,16	7,20	0,188
BASE	0.15	0,21	-0,00049	-0,15	0,71	-4,59	-4,60	0,188

DISEÑO PARA ANTEPECHOS

Story	Fx	Wx	ax	ap	Rp	Fp	M	V
N+3.45	98,67	69,03	0,500	2,5	6	1,422	2,177	2,488
BASE	-54,44	69,03	-0,789	2,5	6	-2,243	-3,434	-3,925

	Sección columneta			As. (cm2)		Separación column.		Fl. 1/4"
Story	b	d	ρ	neces.	ubicado	S max	$S_{escogida}$	$S_{estribos}$
N+3.45	0.15	0,21	0,00079	0,25	0,71	2,85	2,80	0,188
BASE	0.15	0,21	-0,00122	-0,38	0,71	-1,85	-1,80	0,188

8 ESPECIFICACIONES TÉCNICAS

Los materiales utilizados son:

Concreto 21.1 MPa para vigas, placas, zapatas y

columnas. Concreto 14 MPa (para concreto de limpieza).

Acero para refuerzo fy = 420 MPa para todos los diámetros.

Acero estructural A36 pernos de anclaje y platinas

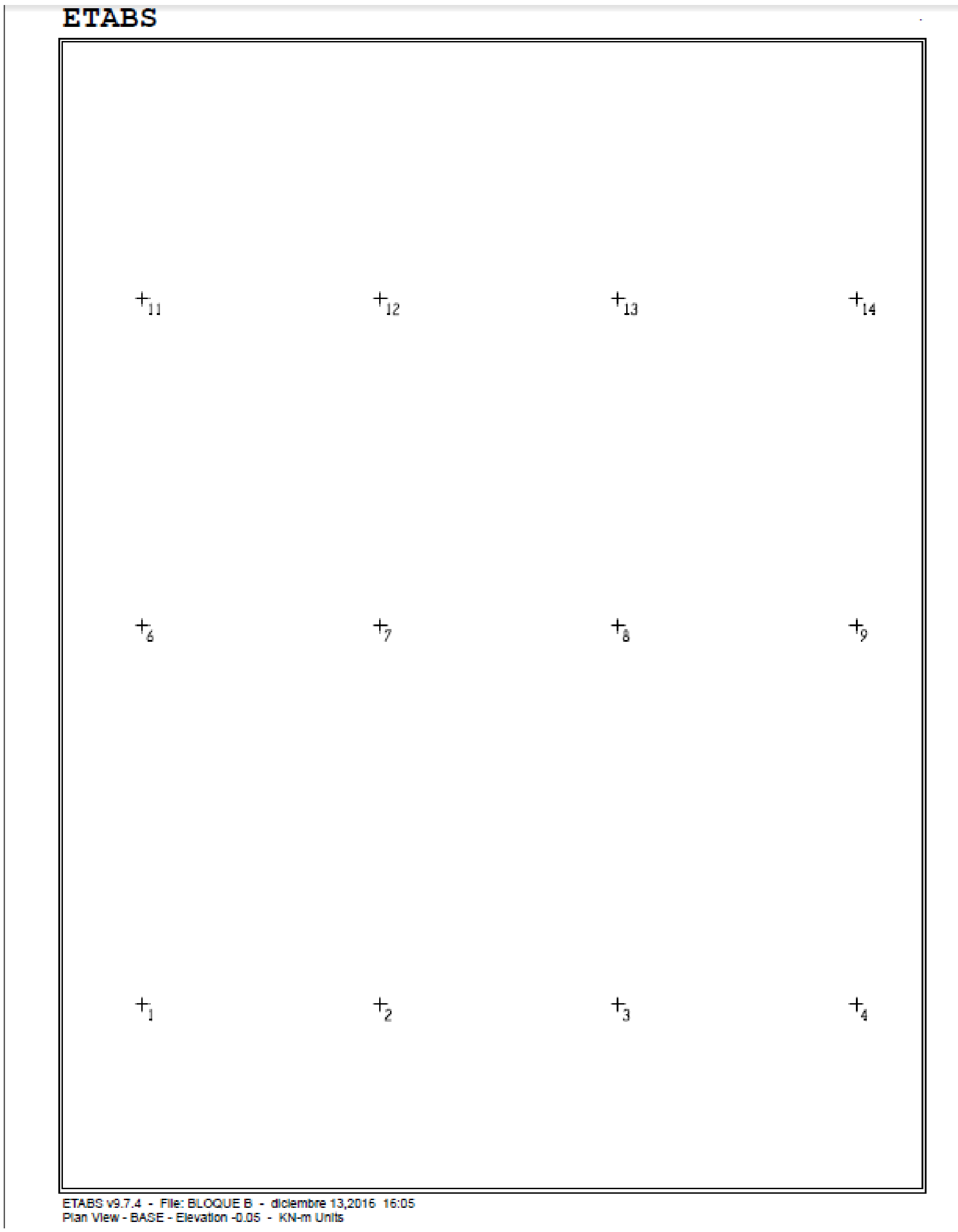
Acero estructural A500 en perfiles metálicos

9 CONCLUSIONES Y RECOMENDACIONES

Habiendo finalizado el diseño y análisis estructural de la institución educativa Alfredo Bonilla sede No 2 Maria Inmaculada Grupo 002 basado en la Norma Colombiana de Diseño y Construcción Sismo Resistente Ley 400 de 1997 (Modificada Ley 1229 de 2008) y Decreto 926 de Marzo de 2010, Decreto 092 del 17 de Enero de
2011, Decreto 0340 del 13 de Febrero de 2012 y en el Reglamento para Concreto Estructural ACI 318S-08,
hemos llegado a las siguientes conclusiones y
recomendaciones.

- Se cumplió satisfactoriamente con los objetivos del cálculo y diseño estructural mediante la aplicación de la norma sismo resistente (NSR-10) y el reglamento para concreto estructural ACI 318S-08, además de la ayuda del software ETABS V9.7.4 se puede garantizar el buen funcionamiento de la estructura que presenta una buena respuesta ante un evento sísmico.
- La revisión de los desplazamientos laterales (derivas) de la estructura teniendo en cuenta las direcciones "X" y "y", nos arrojó que los resultados obtenidos son aceptables permitiendo un buen funcionamiento ante la actuación de un sismo y que cumple con lo establecido en la norma sismo resistente (NSR-10).
- En cuanto a la revisión de columnas y vigas determinamos que cumplen con los requisitos, ya que en estructuras de edificios aporticados es obligatorio que los miembros horizontales fallen antes que los verticales, permitiendo de esa manera un retraso del colapso total de la estructura.
- Para la construcción de la estructura se recomienda llevar un estricto control en la calidad de los materiales a utilizar, ya que estos deberán cumplir con requisitos especiales para el buen funcionamiento de la edificación. Además que estos deberán ser supervisados a la hora de la puesta en marcha por el ingeniero residente.

9 ANEXOS


ETABS
11
12
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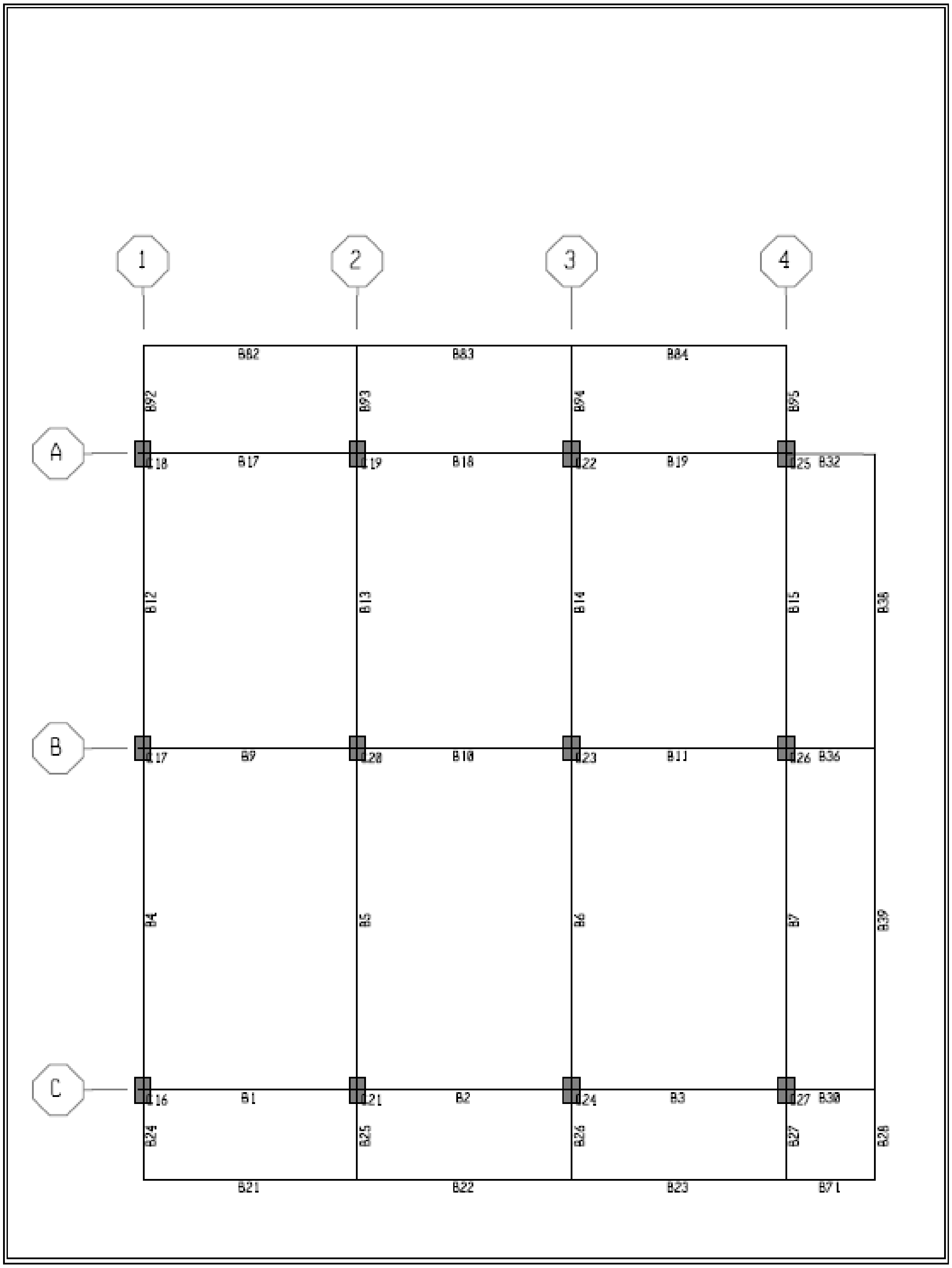
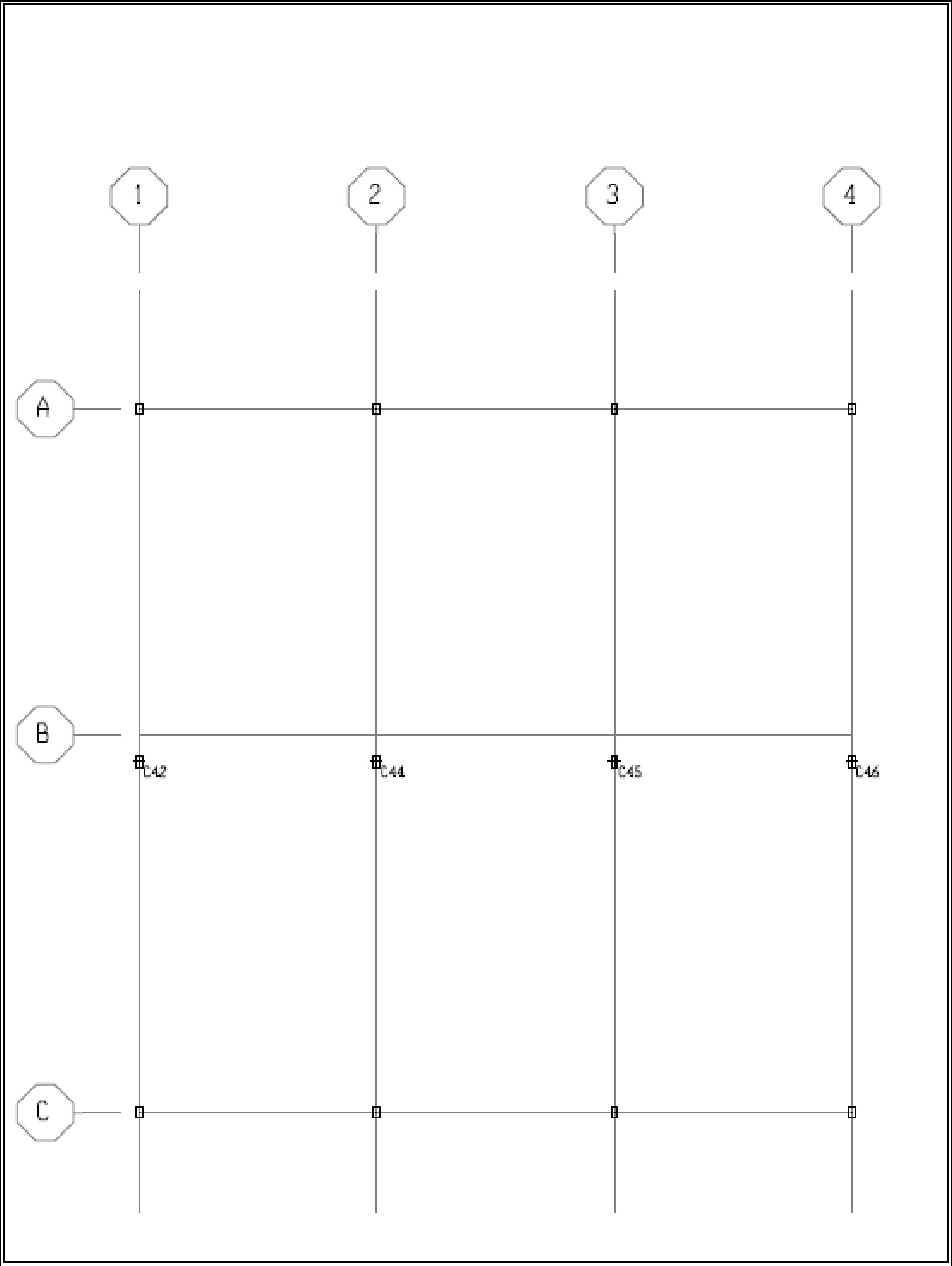
ETABS v9.7.4 - File: BLOQUE B - diciembre 13,2016 16:05
Plan View - BASE - Elevation -0.05 - KN-m Units

ETABS



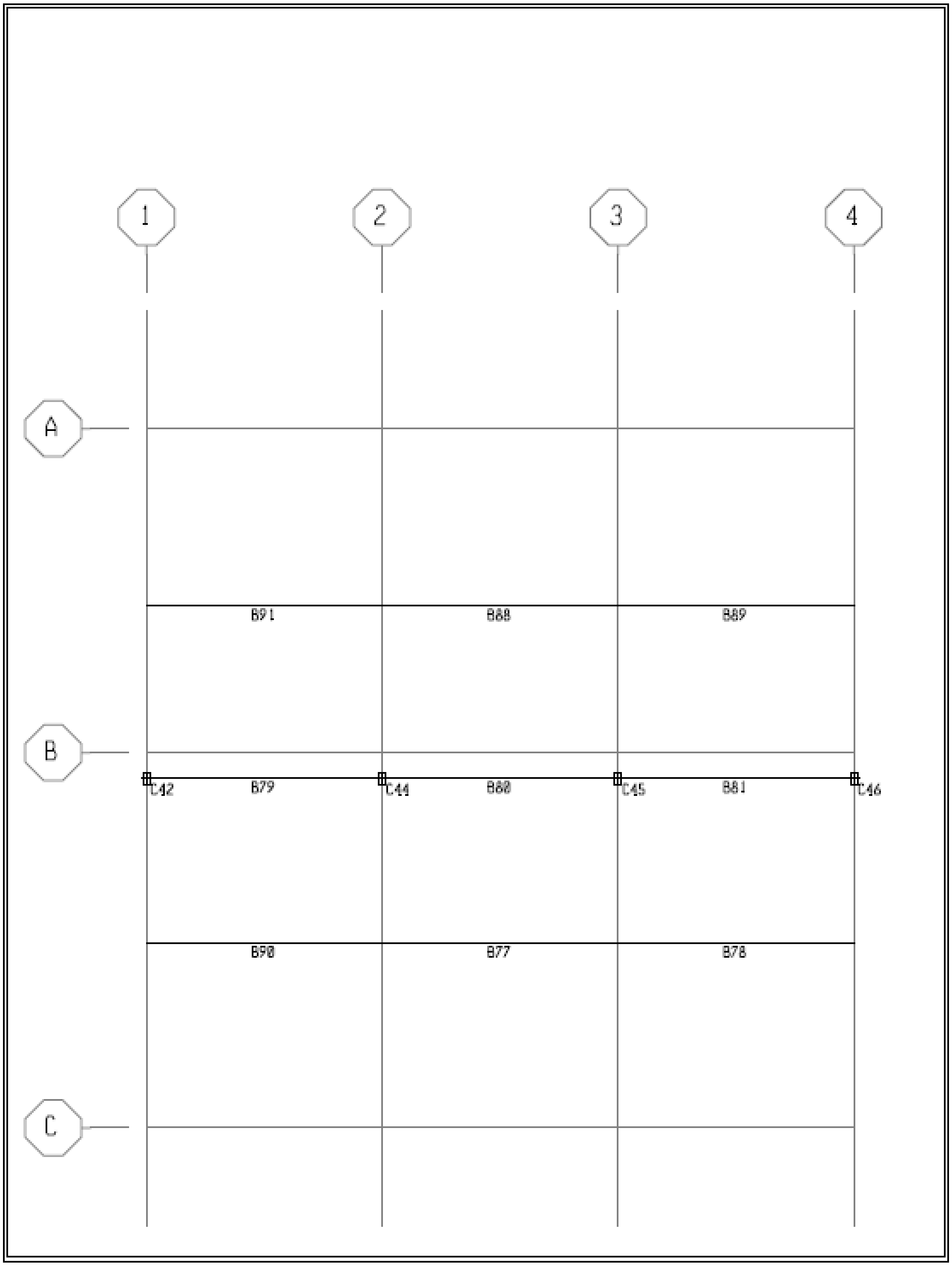
ETABS v9.7.4 - File: BLOQUE B - diciembre 13,2016 16:06
Plan View - N+3.45 - Elevation 3.45 - KN-m Units

ETABS



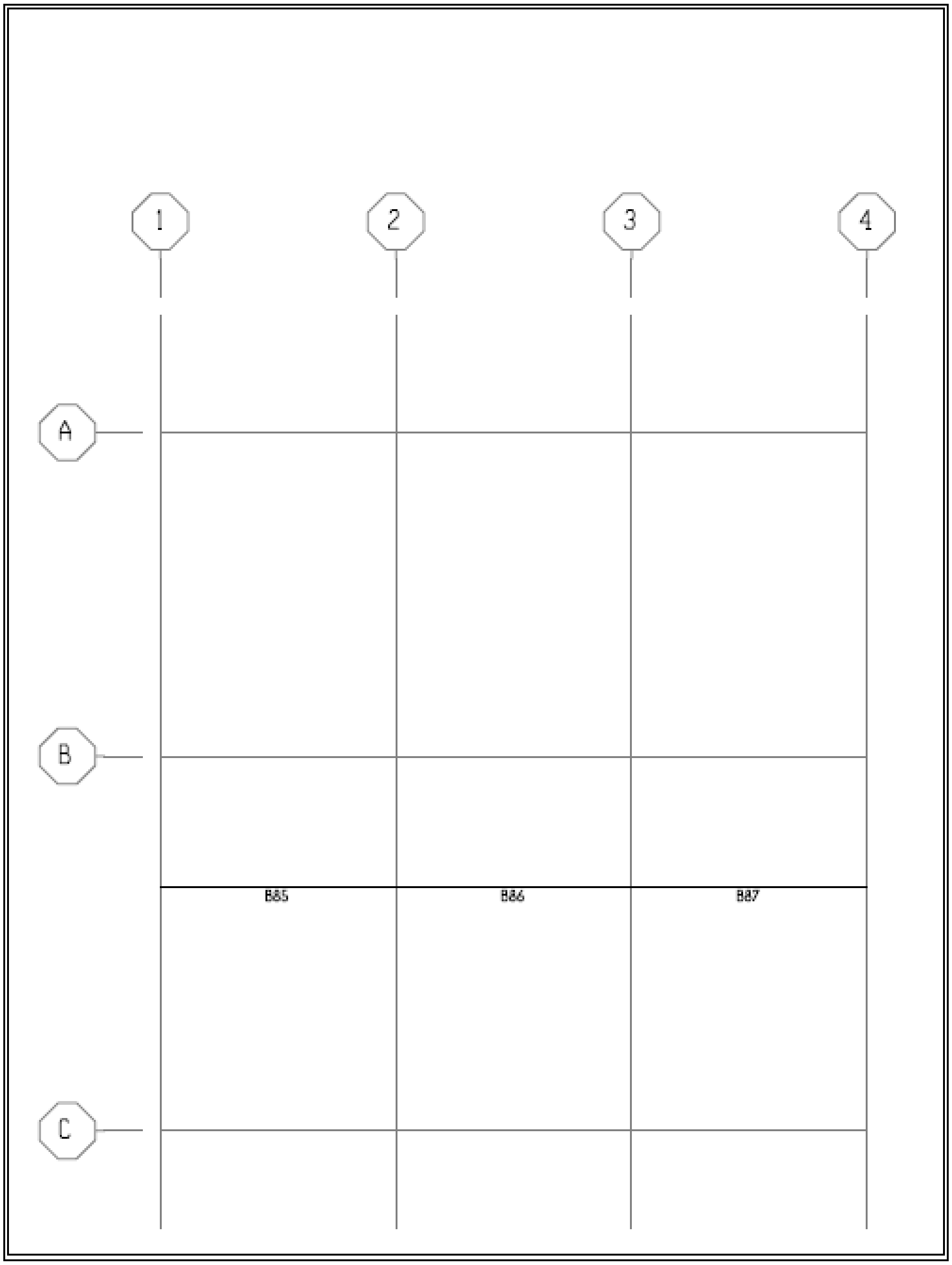
ETABS v9.7.4 - File: BLOQUE B - diciembre 13,2016 16:07
Plan View - N+3.95 - Elevation 4.1 - KN-m Units

ETABS



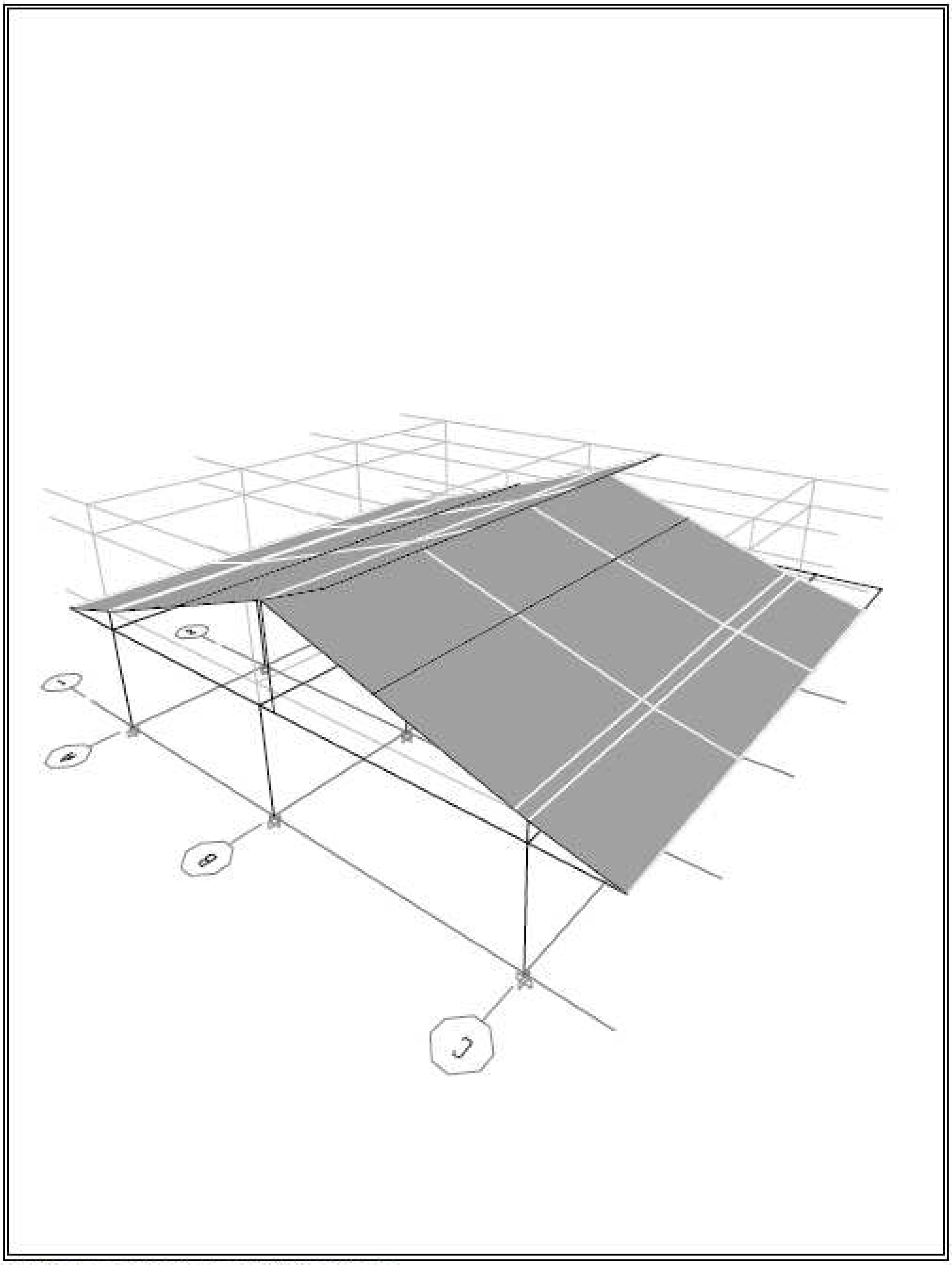
ETABS v9.7.4 - File: BLOQUE B - diciembre 13,2016 16:07
Plan View - N+5.34 - Elevation 6.55 - KN-m Units

ETABS



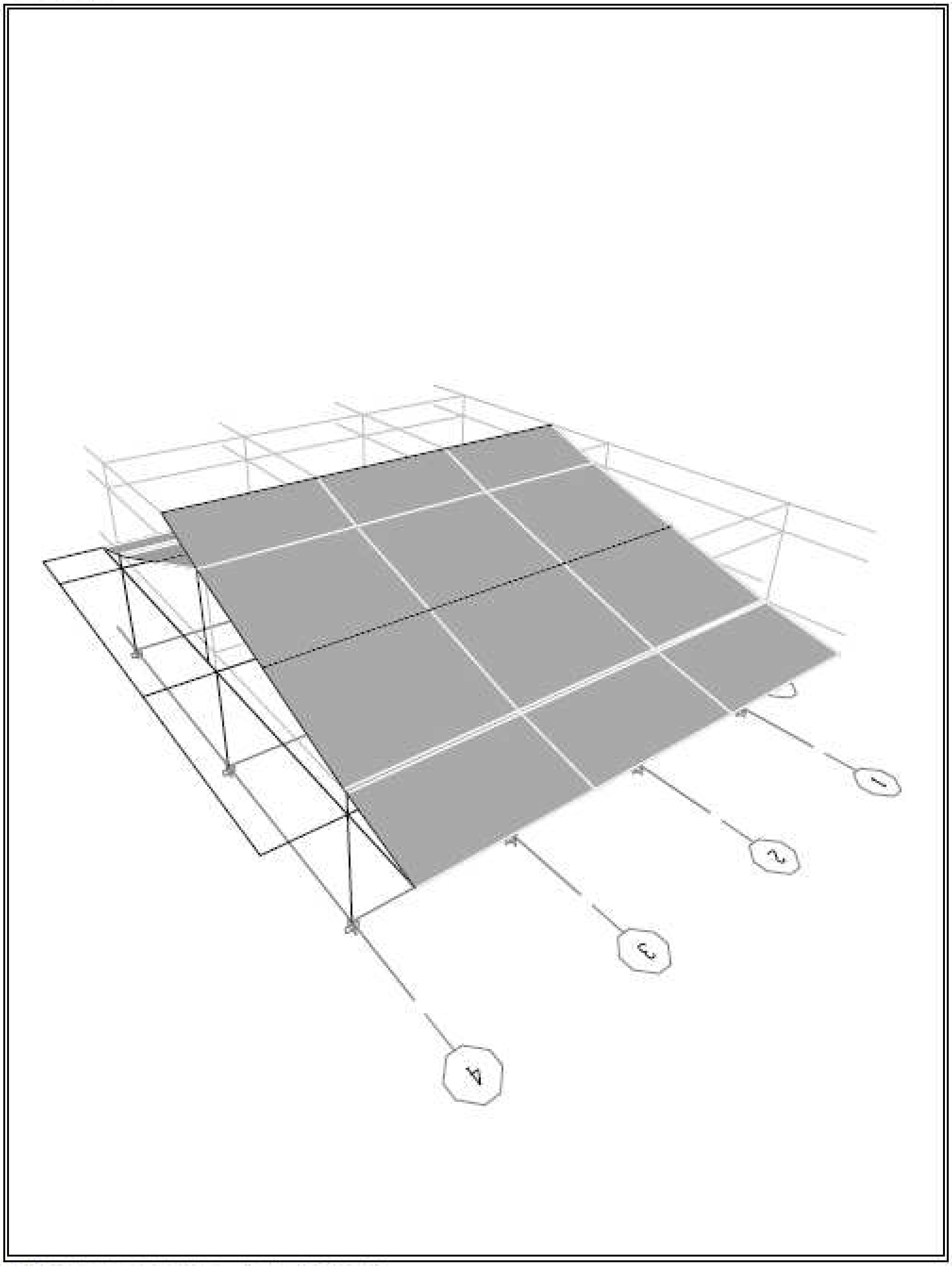
ETABS v9.7.4 - File: BLOQUE B - diciembre 13,2016 16:08
Plan View - N+5.93 - Elevation 7.45 - KN-m Units

ETABS



ETABS v9.7.4 - File: BLOQUE B - diciembre 13,2016 16:09
3-D View - KN-m Units

ETABS



ETABS v9.7.4 - File: BLOQUE B - diciembre 13,2016 16:09
3-D View - KN-m Units

9.1 DATOS DE ENTRADA

ETABS v9.7.4 File:BLOQUE B Units:KN-m diciembre 13, 2016 8:43 PAGE 1

S T O R Y   D A T A

STORY	SIMILAR TO	HEIGHT	ELEVATION
N+5.93	None	0.900	7.450
N+5.34	None	2.450	6.550
N+3.95	None	0.650	4.100
N+3.45	None	3.500	3.450
BASE	None		-0.050

ETABS v9.7.4 File:BLOQUE B Units:KN-m diciembre 13, 2016 8:43 PAGE 2

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

POINT	X	Y	DZ-BELOW
1	0.000	0.000	0.000
2	5.270	0.000	0.000
3	10.540	0.000	0.000
4	15.810	0.000	0.000
5	18.010	0.000	0.000
6	0.000	8.394	0.000
7	5.270	8.394	0.000
8	10.540	8.394	0.000
9	15.810	8.394	0.000
11	0.000	15.630	0.000
12	5.270	15.630	0.000
13	10.540	15.630	0.000
14	15.810	15.630	0.000
15	18.010	15.620	0.000
19	0.000	-2.200	0.000
20	5.270	-2.200	0.000
21	10.540	-2.200	0.000
22	15.810	-2.200	0.000
23	18.010	-2.200	0.000
26	18.010	8.394	0.000
36	0.000	18.270	0.000
57	5.270	18.270	0.000
63	10.540	18.270	0.000
68	15.810	18.270	0.000
110	0.000	5.460	0.000
117	0.000	7.810	0.000
120	5.270	7.810	0.000
122	5.270	15.503	0.000
123	5.270	5.460	0.000
12-1	5.270	15.630	0.023
124	10.540	7.810	0.000
125	10.540	0.448	0.000
126	10.540	15.503	0.000
127	10.540	5.460	0.000
13-2	10.540	15.630	0.023
3-2	10.540	0.000	0.085
128	15.810	7.810	0.000
129	15.810	0.448	0.000
130	15.810	15.503	0.000
131	15.810	5.460	0.000
14-1	15.810	15.630	0.023
4-1	15.810	0.000	0.085
168	5.270	4.129	0.000
168-1	5.270	4.129	1.225
169	10.540	4.129	0.000
169-1	10.540	4.129	1.225
170	15.810	4.129	0.000
170-1	15.810	4.129	1.225
172	5.270	11.656	0.000
172-1	5.270	11.656	1.225
173	10.540	11.656	0.000
173-1	10.540	11.656	1.225
174	15.810	11.656	0.000
174-1	15.810	11.656	1.225
2-2	5.270	0.000	0.367
2-3	5.270	0.000	0.110
176	5.270	0.340	0.000
177	0.000	15.503	0.000
11-1	0.000	15.630	0.023

B77	168-1	169-1
B78	169-1	170-1
B79	117	120
B80	120	124
B81	124	128
B82	36	57
B83	57	63
B84	63	68
B85	110	123
B86	123	127
B87	127	131
B88	172-1	173-1
B89	173-1	174-1
B90	178-1	168-1
B91	179-1	172-1
B92	11	36
B93	12	57
B94	13	63
B95	14	68

ETABS v9.7.4 File:BLOQUE B Units:KN-m diciembre 13, 2016 8:43 PAGE 5

B R A C E   C O N N E C T I V I T Y   D A T A

BRACE	I END PT	J END PT	I END STORY
D117	117	110	Below
D123	122	120	Below
D124	120	123	Below
D125	57	12-1	Below
D126	12-1	122	Same
D128	125	124	Below
D129	126	124	Below
D130	124	127	Below
D131	63	13-2	Below
D132	13-2	126	Same
D133	21	125	Below
D134	129	128	Below
D135	130	128	Below
D136	128	131	Below
D137	68	14-1	Below
D138	14-1	130	Same
D139	22	129	Below
D171	20	2-3	Below
D173	2-3	176	Same
D174	176	168-1	Below
D178	168-1	120	Same
D179	177	117	Below
D180	36	11-1	Below
D181	11-1	177	Same
D182	19	1-3	Below
D183	1-3	180	Same
D184	180	178-1	Below
D185	178-1	117	Same

ETABS v9.7.4 File:BLOQUE B Units:KN-m diciembre 13, 2016 8:43 PAGE 6

R I G I D   D I A P H R A G M   P O I N T   C O N N E C T I V I T Y   D A T A

STORY	DIAPHRAGM	POINT	POINT	POINT	POINT	POINT
N+3.45	D1	1	2	3	4	6
		7	8	9	11	12
		13	14	5	15	20
		21	22	23	26	19

ETABS v9.7.4 File:BLOQUE B Units:KN-m diciembre 13, 2016 8:43 PAGE 7

M A T E R I A L   P R O P E R T Y   D A T A

MATERIAL NAME	MATERIAL TYPE	DESIGN TYPE	MATERIAL DIR/PLANE	MODULUS OF ELASTICITY	POISSON'S RATIO	THERMAL COEFF	SHEAR MODULUS
STEEL	Iso	Steel	All	199947978.80	0.3000	1.1700E-05	76903068.77
CONC21	Iso	Concrete	All	21538000.000	0.2000	9.9000E-06	8974166.667
OTHER	Iso	None	All	199947978.80	0.3000	1.1700E-05	76903068.77
A500	Iso	Steel	All	199900000.00	0.3000	1.1700E-05	76884615.38

178	0.000	4.129	0.000
178-1	0.000	4.129	1.225
179	0.000	11.656	0.000
179-1	0.000	11.656	1.225
1-2	0.000	0.000	0.367
1-3	0.000	0.000	0.110
180	0.000	0.340	0.000

ETABS v9.7.4 File:BLOQUE B Units:KN-m diciembre 13, 2016 8:43 PAGE 3

C O L U M N   C O N N E C T I V I T Y   D A T A

COLUMN	I END PT	J END PT	I END STORY
C16	1	1	Below
C17	6	6	Below
C18	11	11	Below
C19	12	12	Below
C20	7	7	Below
C21	2	2	Below
C22	13	13	Below
C23	8	8	Below
C24	3	3	Below
C25	14	14	Below
C26	9	9	Below
C27	4	4	Below
C42	117	117	Below
C44	120	120	Below
C19-1	12	12-1	Below
C45	124	124	Below
C22-2	13	13-2	Below
C24-2	3	3-2	Below
C46	128	128	Below
C25-1	14	14-1	Below
C27-1	4	4-1	Below
C21-2	2	2-2	Below
C21-4	2-2	2-3	Same
C18-1	11	11-1	Below
C16-2	1	1-2	Below
C16-3	1-2	1-3	Same

ETABS v9.7.4 File:BLOQUE B Units:KN-m diciembre 13, 2016 8:43 PAGE 4

B E A M   C O N N E C T I V I T Y   D A T A

BEAM	I END PT	J END PT
B1	1	2
B2	2	3
B3	3	4
B4	1	6
B5	2	7
B6	3	8
B7	4	9
B9	6	7
B10	7	8
B11	8	9
B12	6	11
B13	7	12
B14	8	13
B15	9	14
B17	11	12
B18	12	13
B19	13	14
B21	19	20
B22	20	21
B23	21	22
B24	19	1
B25	20	2
B26	21	3
B27	22	4
B28	23	5
B30	4	5
B32	14	15
B36	9	26
B38	15	26
B39	26	5
B71	22	23

CUB	Iso	Concrete	All	0.000	0.2000	9.9000E-06	0.000

M A T E R I A L   P R O P E R T Y   M A S S   A N D   W E I G H T

MATERIAL NAME	MASS PER UNIT VOL	WEIGHT PER UNIT VOL
STEEL	7.8271E+00	7.6820E+01
CONC21	2.4000E+00	2.4000E+01
OTHER	7.8271E+00	7.6820E+01
A500	7.8271E+00	7.6820E+01
CUB	2.4000E+00	0.0000E+00

M A T E R I A L   D E S I G N   D A T A   F O R   S T E E L   M A T E R I A L S

MATERIAL NAME	STEEL FY	STEEL FU	STEEL COST ($)
STEEL	344737.894	448159.263	271447.16
A500	352000.000	400000.000	5000.00

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

MATERIAL NAME	LIGHTWEIGHT CONCRETE	CONCRETE FC	REBAR FY	REBAR FYS	LIGHTWT REDUC FACT
CONC21	No	21000.000	420000.000	420000.000	N/A
CUB	No	21000.000	420000.000	420000.000	N/A

ETABS v9.7.4 File:BLOQUE B Units:KN-m diciembre 13, 2016 8:43 PAGE 8

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

FRAME SECTION NAME	MATERIAL NAME	SECTION SHAPE NAME OR NAME IN SECTION DATABASE FILE	CONC COL	CONC BEAM
VIG40X45	CONC21	Rectangular		Yes
VIG20X45	CONC21	Rectangular		Yes
COL40X60	CONC21	Rectangular	Yes	
180X65X4	A500	Box/Tube		
PERFILCOL	A500	Box/Tube		

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

FRAME SECTION NAME	SECTION DEPTH	FLANGE WIDTH TOP	FLANGE THICK TOP	WEB THICK	FLANGE WIDTH BOT	FLANGE THICK BOT
VIG40X45	0.4500	0.4000	0.0000	0.0000	0.0000	0.0000
VIG20X45	0.4500	0.2000	0.0000	0.0000	0.0000	0.0000
COL40X60	0.4000	0.6000	0.0000	0.0000	0.0000	0.0000
180X65X4	0.1800	0.0650	0.0040	0.0040	0.0000	0.0000
PERFILCOL	0.1500	0.2500	0.0050	0.0050	0.0000	0.0000

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

FRAME SECTION NAME	SECTION AREA	TORSIONAL CONSTANT	MOMENTS OF INERTIA I33	I22	SHEAR AREAS A2	A3
VIG40X45	0.1800	0.0045	0.0030	0.0024	0.1500	0.1500
VIG20X45	0.0900	0.0009	0.0015	0.0003	0.0750	0.0750
COL40X60	0.2400	0.0075	0.0032	0.0072	0.2000	0.2000
180X65X4	0.0019	0.0000	0.0000	0.0000	0.0014	0.0005
PERFILCOL	0.0039	0.0000	0.0000	0.0000	0.0015	0.0025

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

FRAME SECTION NAME	SECTION MODULI S33	S22	PLASTIC MODULI Z33	Z22	RADIUS OF GYRATION R33	R22
VIG40X45	0.0135	0.0120	0.0203	0.0180	0.1299	0.1155
VIG20X45	0.0068	0.0030	0.0101	0.0045	0.1299	0.0577
COL40X60	0.0160	0.0240	0.0240	0.0360	0.1155	0.1732

180X65X4	0.0001	0.0000	0.0001	0.0001	0.0626	0.0278
PERFILCOL	0.0002	0.0003	0.0002	0.0003	0.0629	0.0934

F R A M E   S E C T I O N   W E I G H T S   A N D   M A S S E S

FRAME SECTION NAME	TOTAL WEIGHT	TOTAL MASS
VIG40X45	503.4961	50.3496
VIG20X45	38.4912	3.8491
COL40X60	241.9200	24.1920
180X65X4	30.8909	3.1475
PERFILCOL	5.1287	0.5226

C O N C R E T E   C O L U M N   D A T A

FRAME SECTION NAME	REINF CONFIGURATION LONGIT	LATERAL	REINF SIZE/TYPE	NUM BARS 3DIR/2DIR	NUM BARS CIRCULAR	BAR COVER
COL40X60	Rectangular	Ties	#9/Design	3/3	N/A	0.0457

C O N C R E T E   B E A M   D A T A

FRAME SECTION NAME	TOP COVER	BOT COVER	TOP LEFT AREA	TOP RIGHT AREA	BOT LEFT AREA	BOT RIGHT AREA
VIG40X45	0.0500	0.0500	0.000	0.000	0.000	0.000
VIG20X45	0.0500	0.0500	0.000	0.000	0.000	0.000

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

SHELL SECTION	MATERIAL NAME	SHELL TYPE	LOAD DIST ONE WAY	MEMBRANE THICK	BENDING THICK	TOTAL WEIGHT	TOTAL MASS
CUBLIV	CUB	Membrane	Yes	0.0130	0.0130	0.0000	11.7979

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

STATIC CASE	CASE TYPE	AUTO LAT LOAD	SELF WT MULTIPLIER	NOTIONAL FACTOR	NOTIONAL DIRECTION
DEAD	DEAD	N/A	1.0000		
LIVE	LIVE	N/A	0.0000		
VIENTO	WIND	None	0.0000		

R E S P O N S E   S P E C T R U M   C A S E S

RESP SPEC CASE: SISDERX

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0500	0.0000	0.0500

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	DERIVAS	11.0660
U2	----	N/A
UZ	----	N/A

RESP SPEC CASE: SISDERY

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0500	0.0000	0.0500

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	----	N/A
U2	DERIVAS	11.1730
UZ	----	N/A

RESP SPEC CASE: SISDISX

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0500	0.0000	0.0500

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	DISENO	11.0660
U2	----	N/A
UZ	----	N/A

RESP SPEC CASE: SISDISY

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0500	0.0000	0.0500

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	----	N/A
U2	DISENO	11.1730
UZ	----	N/A

RESP SPEC CASE: SISUMBX

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0200	0.0000	0.0200

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	UMBRAL	17.5800
U2	----	N/A
UZ	----	N/A

RESP SPEC CASE: SISUMBY

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0200	0.0000	0.0200

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	----	N/A
U2	UMBRAL	18.3760
UZ	----	N/A

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L O A D I N G   C O M B I N A T I O N S

COMBO	COMBO TYPE	CASE	CASE TYPE	SCALE FACTOR
CIM1	ADD	DEAD	Static	1.0000
		LIVE	Static	1.0000
COMDIS1	ADD	DEAD	Static	1.4000
COMDIS2	ADD	DEAD	Static	1.2000
		LIVE	Static	1.6000
COMDIS3	ADD	DEAD	Static	1.2000
		LIVE	Static	1.0000
		SISDISX	Spectra	1.0000
		SISDISY	Spectra	0.3000
COMDIS4	ADD	DEAD	Static	1.2000
		LIVE	Static	1.0000
		SISDISX	Spectra	0.3000
		SISDISY	Spectra	1.0000
COMDIS5	ADD	DEAD	Static	0.9000
		SISDISX	Spectra	1.0000
		SISDISY	Spectra	0.3000
COMDIS6	ADD	DEAD	Static	0.9000
		SISDISX	Spectra	0.3000
		SISDISY	Spectra	1.0000
CIM2	ADD	DEAD	Static	1.0000
		LIVE	Static	0.7500
		SISDISX	Spectra	0.5250
		SISDISY	Spectra	0.1575
CIM3	ADD	DEAD	Static	1.0000
		LIVE	Static	0.7500
		SISDISX	Spectra	0.1575
		SISDISY	Spectra	0.5250
COMDER1	ADD	SISDERX	Spectra	1.0000
		SISDERY	Spectra	0.3000
COMDER2	ADD	SISDERX	Spectra	0.3000
		SISDERY	Spectra	1.0000
COMDERUMB1	ADD	SISUMBX	Spectra	1.0000
		SISUMBY	Spectra	0.3000
COMDERUMB2	ADD	SISUMBX	Spectra	0.3000
		SISUMBY	Spectra	1.0000
COMDIS7	ADD	DEAD	Static	1.2000
		LIVE	Static	1.6000
		VIENTO	Static	0.8000
COMDIS8	ADD	DEAD	Static	1.2000
		VIENTO	Static	1.6000
		LIVE	Static	1.0000
COMDIS9	ADD	DEAD	Static	0.9000
		VIENTO	Static	1.6000
COMDIS10	ADD	DEAD	Static	1.2000
		VIENTO	Static	-0.8000
		LIVE	Static	1.6000
COMDIS11	ADD	DEAD	Static	0.9000
		VIENTO	Static	-1.6000
ENVOLVENTE	ENVE	COMDIS1	Combo	1.0000
		COMDIS2	Combo	1.0000
		COMDIS3	Combo	1.0000
		COMDIS4	Combo	1.0000
		COMDIS5	Combo	1.0000
		COMDIS6	Combo	1.0000
		COMDIS7	Combo	1.0000
		COMDIS8	Combo	1.0000

COMDIS9	Combo	1.0000
COMDIS10	Combo	1.0000
COMDIS11	Combo	1.0000

R E S P O N S E   S P E C T R U M   F U N C T I O N   -   F R O M   F I L E

FUNCTION NAME: DERIVAS

FILE NAME: c:\users\dyein_000\desktop\cristian\maria inmaculada\modelo\bloque b\derivas.txt
DATA TYPE: Period vs Acceleration
NUMBER OF HEADER LINES = 0

PERIOD	ACCEL
0.0000	1.1330
0.0500	1.1330
0.1000	1.1330
0.1600	1.1330
0.2100	1.1330
0.4000	1.1330
0.6000	1.1330
0.8000	1.1330
0.9900	1.1330
1.3400	0.8410
1.6800	0.6690
2.0300	0.5550
2.3700	0.4740
2.7200	0.4140
3.0600	0.3670
3.4100	0.3300
3.7500	0.3000
4.1000	0.2750
4.4400	0.2530
4.7900	0.2350
5.1300	0.2190
5.4800	0.2050
5.8200	0.1930
6.1700	0.1820
6.5100	0.1730
6.8600	0.1640
7.2000	0.1560
8.2000	0.1200
9.2000	0.0960

FUNCTION NAME: DISENO

FILE NAME: c:\users\dyein_000\desktop\cristian\maria inmaculada\modelo\bloque b\diseño.txt
DATA TYPE: Period vs Acceleration
NUMBER OF HEADER LINES = 0

PERIOD	ACCEL
0.0000	0.1618
0.0500	0.1618
0.1000	0.1618
0.1600	0.1618
0.2100	0.1618
0.4000	0.1618
0.6000	0.1618
0.8000	0.1618
0.9900	0.1618
1.3400	0.1201
1.6800	0.0955
2.0300	0.0793
2.3700	0.0677
2.7200	0.0591
3.0600	0.0525
3.4100	0.0472
3.7500	0.0428
4.1000	0.0392
4.4400	0.0362
4.7900	0.0336
5.1300	0.0313

5.4800	0.0293
5.8200	0.0276
6.1700	0.0261
6.5100	0.0247
6.8600	0.0234
7.2000	0.0223
8.2000	0.0172
9.2000	0.0137

FUNCTION NAME: UMBRAL

FILE NAME: c:\users\dyein_000\desktop\cristian\maria inmaculada\modelo\bloque b\umbral.txt
DATA TYPE: Period vs Acceleration
NUMBER OF HEADER LINES = 0

PERIOD	ACCEL
0.0000	0.0900
0.0500	0.1260
0.1000	0.1620
0.1500	0.1980
0.2000	0.2340
0.2500	0.2700
0.4900	0.2700
0.7300	0.2700
0.9800	0.2700
1.2200	0.2700
1.4600	0.2700
1.7000	0.2700
1.9500	0.2700
2.1900	0.2700
2.7800	0.2120
3.3800	0.1750
3.9700	0.1490
4.5600	0.1290
5.1600	0.1150
5.7500	0.1030
6.3400	0.0930
6.9400	0.0850
7.5300	0.0780
8.1300	0.0730
8.7200	0.0680
9.3100	0.0630
9.9100	0.0600
10.5000	0.0560
11.5000	0.0470
12.5000	0.0400

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F R A M E S E C T I O N A S S I G N M E N T S T O L I N E O B J E C T S

STORY LEVEL	LINE ID	LINE TYPE	SECTION TYPE	AUTO SELECT SECTION	ANALYSIS SECTION	DESIGN PROCEDURE	DESIGN SECTION
N+5.34	C42	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+5.34	C44	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+5.34	C45	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+5.34	C46	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+3.95	C42	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+3.95	C44	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+3.95	C19-1	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+3.95	C45	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+3.95	C22-2	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+3.95	C24-2	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+3.95	C46	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+3.95	C25-1	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+3.95	C27-1	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+3.95	C21-2	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+3.95	C21-4	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+3.95	C18-1	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+3.95	C16-2	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+3.95	C16-3	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+3.45	C16	Column	Rectangular	None	COL40X60	Conc Frame	COL40X60
N+3.45	C17	Column	Rectangular	None	COL40X60	Conc Frame	COL40X60
N+3.45	C18	Column	Rectangular	None	COL40X60	Conc Frame	COL40X60

N+3.45	C19	Column	Rectangular	None	COL40X60	Conc Frame	COL40X60
N+3.45	C20	Column	Rectangular	None	COL40X60	Conc Frame	COL40X60
N+3.45	C21	Column	Rectangular	None	COL40X60	Conc Frame	COL40X60
N+3.45	C22	Column	Rectangular	None	COL40X60	Conc Frame	COL40X60
N+3.45	C23	Column	Rectangular	None	COL40X60	Conc Frame	COL40X60
N+3.45	C24	Column	Rectangular	None	COL40X60	Conc Frame	COL40X60
N+3.45	C25	Column	Rectangular	None	COL40X60	Conc Frame	COL40X60
N+3.45	C26	Column	Rectangular	None	COL40X60	Conc Frame	COL40X60
N+3.45	C27	Column	Rectangular	None	COL40X60	Conc Frame	COL40X60
N+5.93	B85	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.93	B86	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.93	B87	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	B77	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	B78	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	B79	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	B80	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	B81	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	B88	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	B89	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	B90	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	B91	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.45	B1	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B2	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B3	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B4	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B5	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B6	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B7	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B9	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B10	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B11	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B12	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B13	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B14	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B15	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B17	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B18	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B19	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B21	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.45	B22	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.45	B23	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.45	B24	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.45	B25	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.45	B26	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.45	B27	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.45	B28	Beam	Rectangular	None	VIG20X45	Conc Frame	VIG20X45
N+3.45	B30	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B32	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B36	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B38	Beam	Rectangular	None	VIG20X45	Conc Frame	VIG20X45
N+3.45	B39	Beam	Rectangular	None	VIG20X45	Conc Frame	VIG20X45
N+3.45	B71	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.45	B82	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.45	B83	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.45	B84	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.45	B92	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.45	B93	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.45	B94	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.45	B95	Beam	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.93	D117	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.93	D124	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.93	D130	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.93	D136	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	D123	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	D128	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	D129	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	D134	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	D135	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	D174	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	D178	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	D179	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	D184	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+5.34	D185	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.95	D125	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.95	D126	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.95	D131	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.95	D132	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4
N+3.95	D133	Brace	Box/Tube	None	180X65X4	Steel Frame	180X65X4

N+3.95	D137	Brace	Box/Tube	None	180X65X4	Steel Frame 180X65X4
N+3.95	D138	Brace	Box/Tube	None	180X65X4	Steel Frame 180X65X4
N+3.95	D139	Brace	Box/Tube	None	180X65X4	Steel Frame 180X65X4
N+3.95	D171	Brace	Box/Tube	None	180X65X4	Steel Frame 180X65X4
N+3.95	D173	Brace	Box/Tube	None	180X65X4	Steel Frame 180X65X4
N+3.95	D180	Brace	Box/Tube	None	180X65X4	Steel Frame 180X65X4
N+3.95	D181	Brace	Box/Tube	None	180X65X4	Steel Frame 180X65X4
N+3.95	D182	Brace	Box/Tube	None	180X65X4	Steel Frame 180X65X4
N+3.95	D183	Brace	Box/Tube	None	180X65X4	Steel Frame 180X65X4

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D I S T R I B U T E D   L O A D   A S S I G N M E N T S   T O   L I N E   O B J E C T S

LOAD CASE	STORY LEVEL	LINE ID	LOAD TYPE	LOAD DIRECTION	ABSOLUTE DISTANCE A	ABSOLUTE DISTANCE B	LOAD A PER LENGTH	LOAD B PER LENGTH
DEAD	N+5.93	D117	Force	Gravity	0.000	2.516	0.100	0.100
DEAD	N+5.93	D124	Force	Gravity	0.000	2.516	0.200	0.200
DEAD	N+5.93	D130	Force	Gravity	0.000	2.516	0.200	0.200
DEAD	N+5.93	D136	Force	Gravity	0.000	2.516	0.100	0.100
DEAD	N+5.34	D123	Force	Gravity	0.000	8.074	0.200	0.200
DEAD	N+5.34	D128	Force	Gravity	0.000	7.759	0.200	0.200
DEAD	N+5.34	D129	Force	Gravity	0.000	8.074	0.200	0.200
DEAD	N+5.34	D134	Force	Gravity	0.000	7.759	0.100	0.100
DEAD	N+5.34	D135	Force	Gravity	0.000	8.074	0.100	0.100
DEAD	N+5.34	D174	Force	Gravity	0.000	3.982	0.200	0.200
DEAD	N+5.34	D178	Force	Gravity	0.000	3.879	0.200	0.200
DEAD	N+5.34	D179	Force	Gravity	0.000	8.074	0.100	0.100
DEAD	N+5.34	D184	Force	Gravity	0.000	3.982	0.100	0.100
DEAD	N+5.34	D185	Force	Gravity	0.000	3.879	0.100	0.100
DEAD	N+3.95	D125	Force	Gravity	0.000	2.713	0.200	0.200
DEAD	N+3.95	D126	Force	Gravity	0.000	0.129	0.200	0.200
DEAD	N+3.95	D131	Force	Gravity	0.000	2.713	0.200	0.200
DEAD	N+3.95	D133	Force	Gravity	0.000	2.727	0.200	0.200
DEAD	N+3.95	D137	Force	Gravity	0.000	2.713	0.100	0.100
DEAD	N+3.95	D139	Force	Gravity	0.000	2.727	0.100	0.100
DEAD	N+3.95	D171	Force	Gravity	0.000	1.363	0.200	0.200
DEAD	N+3.95	D171	Force	Gravity	1.363	2.265	0.200	0.200
DEAD	N+3.95	D173	Force	Gravity	0.000	0.358	0.200	0.200
DEAD	N+3.95	D180	Force	Gravity	0.000	2.713	0.100	0.100
DEAD	N+3.95	D181	Force	Gravity	0.000	0.129	0.100	0.100
DEAD	N+3.95	D182	Force	Gravity	0.000	2.265	0.100	0.100
DEAD	N+3.95	D183	Force	Gravity	0.000	0.358	0.100	0.100
LIVE	N+5.93	D117	Force	Gravity	0.000	2.516	0.130	0.130
LIVE	N+5.93	D124	Force	Gravity	0.000	2.516	0.250	0.250
LIVE	N+5.93	D130	Force	Gravity	0.000	2.516	0.250	0.250
LIVE	N+5.93	D136	Force	Gravity	0.000	2.516	0.130	0.130
LIVE	N+5.34	D123	Force	Gravity	0.000	8.074	0.250	0.250
LIVE	N+5.34	D128	Force	Gravity	0.000	7.759	0.250	0.250
LIVE	N+5.34	D129	Force	Gravity	0.000	8.074	0.250	0.250
LIVE	N+5.34	D134	Force	Gravity	0.000	7.759	0.130	0.130
LIVE	N+5.34	D135	Force	Gravity	0.000	8.074	0.130	0.130
LIVE	N+5.34	D174	Force	Gravity	0.000	3.982	0.250	0.250
LIVE	N+5.34	D178	Force	Gravity	0.000	3.879	0.250	0.250
LIVE	N+5.34	D179	Force	Gravity	0.000	8.074	0.130	0.130
LIVE	N+5.34	D184	Force	Gravity	0.000	3.982	0.130	0.130
LIVE	N+5.34	D185	Force	Gravity	0.000	3.879	0.130	0.130
LIVE	N+3.95	D125	Force	Gravity	0.000	2.713	0.250	0.250
LIVE	N+3.95	D126	Force	Gravity	0.000	0.129	0.250	0.250
LIVE	N+3.95	D131	Force	Gravity	0.000	2.713	0.250	0.250
LIVE	N+3.95	D133	Force	Gravity	0.000	2.727	0.250	0.250
LIVE	N+3.95	D137	Force	Gravity	0.000	2.713	0.130	0.130
LIVE	N+3.95	D139	Force	Gravity	0.000	2.727	0.130	0.130
LIVE	N+3.95	D171	Force	Gravity	0.000	1.363	0.250	0.250
LIVE	N+3.95	D171	Force	Gravity	1.363	2.265	0.250	0.250
LIVE	N+3.95	D173	Force	Gravity	0.000	0.358	0.250	0.250
LIVE	N+3.95	D180	Force	Gravity	0.000	2.713	0.130	0.130
LIVE	N+3.95	D181	Force	Gravity	0.000	0.129	0.130	0.130
LIVE	N+3.95	D182	Force	Gravity	0.000	2.265	0.130	0.130
LIVE	N+3.95	D183	Force	Gravity	0.000	0.358	0.130	0.130
VIENTO	N+5.93	D117	Force	Local-2	0.000	2.516	-1.132	-1.132
VIENTO	N+5.93	D124	Force	Local-2	0.000	2.516	-2.108	-2.108
VIENTO	N+5.93	D130	Force	Local-2	0.000	2.516	-2.108	-2.108
VIENTO	N+5.93	D136	Force	Local-2	0.000	2.516	-1.132	-1.132
VIENTO	N+5.34	D123	Force	Local-2	0.000	8.074	-2.108	-2.108
VIENTO	N+5.34	D128	Force	Local-2	0.000	7.759	2.108	2.108
VIENTO	N+5.34	D129	Force	Local-2	0.000	8.074	-2.108	-2.108

VIENTO	N+5.34	D134	Force	Local-2	0.000	7.759	1.132	1.132
VIENTO	N+5.34	D135	Force	Local-2	0.000	8.074	-1.132	-1.132
VIENTO	N+5.34	D174	Force	Local-2	0.000	3.982	2.108	2.108
VIENTO	N+5.34	D178	Force	Local-2	0.000	3.879	2.108	2.108
VIENTO	N+5.34	D179	Force	Local-2	0.000	8.074	-1.132	-1.132
VIENTO	N+5.34	D184	Force	Local-2	0.000	3.982	1.132	1.132
VIENTO	N+5.34	D185	Force	Local-2	0.000	3.879	1.132	1.132
VIENTO	N+3.95	D125	Force	Local-2	0.000	2.713	-2.108	-2.108
VIENTO	N+3.95	D131	Force	Local-2	0.000	2.713	-2.108	-2.108
VIENTO	N+3.95	D133	Force	Local-2	0.000	2.727	2.108	2.108
VIENTO	N+3.95	D137	Force	Local-2	0.000	2.713	-1.132	-1.132
VIENTO	N+3.95	D139	Force	Local-2	0.000	2.727	1.132	1.132
VIENTO	N+3.95	D171	Force	Local-2	0.000	2.265	2.108	2.108
VIENTO	N+3.95	D173	Force	Local-2	0.000	0.358	2.108	2.108
VIENTO	N+3.95	D180	Force	Local-2	0.000	2.713	-1.132	-1.132
VIENTO	N+3.95	D182	Force	Local-2	0.000	2.265	1.132	1.132
VIENTO	N+3.95	D183	Force	Local-2	0.000	0.358	1.132	1.132

9.2 DATOS DE SALIDA

BEAM FORCES
UNID: kN-m

Story	Beam	Load	Loc	P	V2	T	M3
N+3.45	B1	ENVOLVENTE MAX	0	0	-3,45	0,879	11,267
N+3.45	B1	ENVOLVENTE MAX	5,27	0	21,04	0,879	-0,348
N+3.45	B1	ENVOLVENTE MIN	0	0	-16,34	-0,897	-18,64
N+3.45	B1	ENVOLVENTE MIN	5,27	0	6,97	-0,897	-28,694
N+3.45	B2	ENVOLVENTE MAX	0	0	-6,29	0,914	1,704
N+3.45	B2	ENVOLVENTE MAX	5,27	0	17,67	0,914	0,851
N+3.45	B2	ENVOLVENTE MIN	0	0	-17,22	-0,966	-20,967
N+3.45	B2	ENVOLVENTE MIN	5,27	0	6,63	-0,966	-22,193
N+3.45	B3	ENVOLVENTE MAX	0	0	-1,79	0,659	8,863
N+3.45	B3	ENVOLVENTE MAX	5,27	0	23,27	0,659	-7,38
N+3.45	B3	ENVOLVENTE MIN	0	0	-13,97	-0,914	-16,212
N+3.45	B3	ENVOLVENTE MIN	5,27	0	8,77	-0,914	-42,856
N+3.45	B4	ENVOLVENTE MAX	0	0,51	-13,67	0,704	-10,752
N+3.45	B4	ENVOLVENTE MAX	7,81	0,51	22,6	0,704	-6,897
N+3.45	B4	ENVOLVENTE MAX	7,81	4,85	27,06	4,376	-6,367
N+3.45	B4	ENVOLVENTE MAX	8,394	4,85	30,38	4,376	-15,724
N+3.45	B4	ENVOLVENTE MIN	0	-0,36	-24,63	-0,795	-35,512
N+3.45	B4	ENVOLVENTE MIN	7,81	-0,36	12,37	-0,795	-26,028
N+3.45	B4	ENVOLVENTE MIN	7,81	-6,82	14,81	-3,849	-23,277
N+3.45	B4	ENVOLVENTE MIN	8,394	-6,82	17,08	-3,849	-39,912
N+3.45	B5	ENVOLVENTE MAX	0	0,89	-13,21	0,61	-9,075
N+3.45	B5	ENVOLVENTE MAX	7,81	0,89	22,56	0,61	-4,698
N+3.45	B5	ENVOLVENTE MAX	7,81	8,97	31,37	4,328	-7,061
N+3.45	B5	ENVOLVENTE MAX	8,394	8,97	34,4	4,328	-17,936
N+3.45	B5	ENVOLVENTE MIN	0	-0,67	-24,67	-0,568	-37,37
N+3.45	B5	ENVOLVENTE MIN	7,81	-0,67	11,86	-0,568	-24,801
N+3.45	B5	ENVOLVENTE MIN	7,81	-11,77	17,47	-4,762	-20,983
N+3.45	B5	ENVOLVENTE MIN	8,394	-11,77	19,74	-4,762	-40,06
N+3.45	B6	ENVOLVENTE MAX	0	0,88	-13,18	0,581	-9,062
N+3.45	B6	ENVOLVENTE MAX	7,81	0,88	22,61	0,581	-4,743
N+3.45	B6	ENVOLVENTE MAX	7,81	9,02	31,68	4,227	-5,921
N+3.45	B6	ENVOLVENTE MAX	8,394	9,02	34,7	4,227	-16,402
N+3.45	B6	ENVOLVENTE MIN	0	-0,67	-24,63	-0,608	-37,076
N+3.45	B6	ENVOLVENTE MIN	7,81	-0,67	11,89	-0,608	-26,16
N+3.45	B6	ENVOLVENTE MIN	7,81	-11,84	16,51	-4,307	-22,31
N+3.45	B6	ENVOLVENTE MIN	8,394	-11,84	18,78	-4,307	-41,511
N+3.45	B7	ENVOLVENTE MAX	0	0,51	-13,11	0,998	-7,568
N+3.45	B7	ENVOLVENTE MAX	7,81	0,51	22,75	0,998	-6,077
N+3.45	B7	ENVOLVENTE MAX	7,81	4,89	27,94	5,119	-4,224
N+3.45	B7	ENVOLVENTE MAX	8,394	4,89	30,97	5,119	-12,877
N+3.45	B7	ENVOLVENTE MIN	0	-0,37	-24,48	-0,489	-37,412
N+3.45	B7	ENVOLVENTE MIN	7,81	-0,37	12	-0,489	-28,621
N+3.45	B7	ENVOLVENTE MIN	7,81	-6,84	13,65	-3,282	-25,898
N+3.45	B7	ENVOLVENTE MIN	8,394	-6,84	15,92	-3,282	-43,076
N+3.45	B8	ENVOLVENTE MAX	0	0	-4,91	0,677	7,058
N+3.45	B8	ENVOLVENTE MAX	5,27	0	19,57	0,677	-3,672
N+3.45	B8	ENVOLVENTE MIN	0	0	-15,01	-0,619	-14,894
N+3.45	B8	ENVOLVENTE MIN	5,27	0	8,33	-0,619	-25,2
N+3.45	B10	ENVOLVENTE MAX	0	0	-7,45	0,638	-1,251
N+3.45	B10	ENVOLVENTE MAX	5,27	0	16,48	0,638	-1,745
N+3.45	B10	ENVOLVENTE MIN	0	0	-16,23	-0,667	-18,262
N+3.45	B10	ENVOLVENTE MIN	5,27	0	7,64	-0,667	-18,92
N+3.45	B11	ENVOLVENTE MAX	0	0	-2,49	0,557	6,488
N+3.45	B11	ENVOLVENTE MAX	5,27	0	22,79	0,557	-13,523
N+3.45	B11	ENVOLVENTE MIN	0	0	-11,79	-0,578	-11,663
N+3.45	B11	ENVOLVENTE MIN	5,27	0	10,74	-0,578	-42,364
N+3.45	B12	ENVOLVENTE MAX	0	0	-12,28	0,613	-10,498
N+3.45	B12	ENVOLVENTE MAX	7,236	0	20,74	0,613	-4,328
N+3.45	B12	ENVOLVENTE MIN	0	0	-23,03	-0,597	-34,426
N+3.45	B12	ENVOLVENTE MIN	7,236	0	10,81	-0,597	-27,955
N+3.45	B13	ENVOLVENTE MAX	0	0	-12,31	0,339	-10,472
N+3.45	B13	ENVOLVENTE MAX	7,236	0	20,76	0,339	-4,725
N+3.45	B13	ENVOLVENTE MIN	0	0	-23,01	-0,399	-34,563
N+3.45	B13	ENVOLVENTE MIN	7,236	0	10,86	-0,399	-26,663
N+3.45	B14	ENVOLVENTE MAX	0	0	-12,15	0,501	-10,168
N+3.45	B14	ENVOLVENTE MAX	7,236	0	20,79	0,501	-4,068
N+3.45	B14	ENVOLVENTE MIN	0	0	-22,98	-0,277	-34,696
N+3.45	B14	ENVOLVENTE MIN	7,236	0	10,74	-0,277	-28,571
N+3.45	B15	ENVOLVENTE MAX	0	0	-11,48	-0,308	-7,627
N+3.45	B15	ENVOLVENTE MAX	7,236	0	21,04	-0,308	-0,298
N+3.45	B15	ENVOLVENTE MIN	0	0	-23,38	-1,688	-37,873
N+3.45	B15	ENVOLVENTE MIN	7,236	0	9,78	-1,688	-30,738
N+3.45	B17	ENVOLVENTE MAX	0	0	-4,48	0,808	8,349
N+3.45	B17	ENVOLVENTE MAX	5,27	0	19,98	0,808	-2,341
N+3.45	B17	ENVOLVENTE MIN	0	0	-15,53	-0,869	-16,568
N+3.45	B17	ENVOLVENTE MIN	5,27	0	7,82	-0,869	-26,111
N+3.45	B18	ENVOLVENTE MAX	0	0	-6,8	0,873	-0,078
N+3.45	B18	ENVOLVENTE MAX	5,27	0	17,09	0,873	-1,416
N+3.45	B18	ENVOLVENTE MIN	0	0	-16,4	-0,904	-19,048
N+3.45	B18	ENVOLVENTE MIN	5,27	0	7,42	-0,904	-20,898
N+3.45	B19	ENVOLVENTE MAX	0	0	-3,95	0,955	4,779
N+3.45	B19	ENVOLVENTE MAX	5,27	0	20,71	0,955	-5,596
N+3.45	B19	ENVOLVENTE MIN	0	0	-14,62	-0,571	-16,322

Diseños Estructuras

N+3.45	B19	ENVOLVENTE MIN	5,27	0	0,52	-0,571	-34,041
N+3.45	B21	ENVOLVENTE MAX	0	0	-0,26	0,02	0,019
N+3.45	B21	ENVOLVENTE MAX	5,27	0	0,64	0,02	-0,321
N+3.45	B21	ENVOLVENTE MIN	0	0	-0,44	-0,015	-0,123
N+3.45	B21	ENVOLVENTE MIN	5,27	0	0,39	-0,015	-0,591
N+3.45	B22	ENVOLVENTE MAX	0	0	-0,36	0,01	-0,316
N+3.45	B22	ENVOLVENTE MAX	5,27	0	0,5	0,01	-0,239
N+3.45	B22	ENVOLVENTE MIN	0	0	-0,57	-0,012	-0,563
N+3.45	B22	ENVOLVENTE MIN	5,27	0	0,31	-0,012	-0,392
N+3.45	B23	ENVOLVENTE MAX	0	0	-0,24	0,021	-0,175
N+3.45	B23	ENVOLVENTE MAX	5,27	0	0,61	0,021	-0,249
N+3.45	B23	ENVOLVENTE MIN	0	0	-0,47	-0,021	-0,395
N+3.45	B23	ENVOLVENTE MIN	5,27	0	0,33	-0,021	-0,881
N+3.45	B24	ENVOLVENTE MAX	0	0	0,22	0,008	0,087
N+3.45	B24	ENVOLVENTE MAX	2,2	0	0,59	0,008	0,331
N+3.45	B24	ENVOLVENTE MIN	0	0	-0,29	-0,059	-0,025
N+3.45	B24	ENVOLVENTE MIN	2,2	0	0	-0,059	-0,827
N+3.45	B25	ENVOLVENTE MAX	0	0	0,43	0,035	0,193
N+3.45	B25	ENVOLVENTE MAX	2,2	0	0,82	0,035	0,646
N+3.45	B25	ENVOLVENTE MIN	0	0	-0,42	-0,014	-0,05
N+3.45	B25	ENVOLVENTE MIN	2,2	0	-0,14	-0,014	-1,301
N+3.45	B26	ENVOLVENTE MAX	0	0	0,39	0,033	0,145
N+3.45	B26	ENVOLVENTE MAX	2,2	0	0,76	0,033	0,618
N+3.45	B26	ENVOLVENTE MIN	0	0	-0,41	-0,025	-0,063
N+3.45	B26	ENVOLVENTE MIN	2,2	0	-0,12	-0,025	-1,204
N+3.45	B27	ENVOLVENTE MAX	0	0	0,23	0,049	0,126
N+3.45	B27	ENVOLVENTE MAX	2,2	0	0,61	0,049	0,144
N+3.45	B27	ENVOLVENTE MIN	0	0	-0,18	-0,024	0,003
N+3.45	B27	ENVOLVENTE MIN	2,2	0	0,1	-0,024	-0,835
N+3.45	B28	ENVOLVENTE MAX	0	0	0,4	0,875	0,026
N+3.45	B28	ENVOLVENTE MAX	2,2	0	6,8	0,875	-4,291
N+3.45	B28	ENVOLVENTE MIN	0	0	-0,18	-0,046	-0,08
N+3.45	B28	ENVOLVENTE MIN	2,2	0	4,1	-0,046	-7,687
N+3.45	B30	ENVOLVENTE MAX	0	0	-19,96	-0,909	-34,51
N+3.45	B30	ENVOLVENTE MAX	2,2	0	-11,4	-0,909	0,66
N+3.45	B30	ENVOLVENTE MIN	0	0	-32,24	-4,861	-56,004
N+3.45	B30	ENVOLVENTE MIN	2,2	0	-18,83	-4,861	-0,239
N+3.45	B32	ENVOLVENTE MAX	0	0	-14,22	8,86	-22,334
N+3.45	B32	ENVOLVENTE MAX	2,2	0	-5,66	8,86	-0,45
N+3.45	B32	ENVOLVENTE MIN	0	0	-23,06	1,926	-36,948
N+3.45	B32	ENVOLVENTE MIN	2,2	0	-9,76	1,926	-0,841
N+3.45	B36	ENVOLVENTE MAX	0	0	-24,78	3,16	-44,388
N+3.45	B36	ENVOLVENTE MAX	2,2	0	-16,22	3,16	1,08
N+3.45	B36	ENVOLVENTE MIN	0	0	-38,65	-2,193	-69,321
N+3.45	B36	ENVOLVENTE MIN	2,2	0	-25,35	-2,193	0,656
N+3.45	B38	ENVOLVENTE MAX	0	0	-5,66	-0,438	-1,928
N+3.45	B38	ENVOLVENTE MAX	7,226	0	12,09	-0,438	-8,339
N+3.45	B38	ENVOLVENTE MIN	0	0	-9,76	-0,808	-8,864
N+3.45	B38	ENVOLVENTE MIN	7,226	0	7,16	-0,808	-15,64
N+3.45	B39	ENVOLVENTE MAX	0	0	-7,87	0,323	-9,573
N+3.45	B39	ENVOLVENTE MAX	8,194	0	12,13	0,323	-5,435
N+3.45	B39	ENVOLVENTE MIN	0	0	-13,25	0,085	-17,638
N+3.45	B39	ENVOLVENTE MIN	8,194	0	7,25	0,085	-13,935
N+3.45	B71	ENVOLVENTE MAX	0	0	0,08	0,026	-0,223
N+3.45	B71	ENVOLVENTE MAX	2,2	0	0,4	0,026	0,046
N+3.45	B71	ENVOLVENTE MIN	0	0	-0,48	-0,08	-0,857
N+3.45	B71	ENVOLVENTE MIN	2,2	0	-0,18	-0,08	-0,875
N+3.45	B82	ENVOLVENTE MAX	0	0,12	-0,25	0,006	0,057
N+3.45	B82	ENVOLVENTE MAX	5,27	0,12	0,63	0,006	-0,283
N+3.45	B82	ENVOLVENTE MIN	0	-0,11	-0,44	-0,014	-0,161
N+3.45	B82	ENVOLVENTE MIN	5,27	-0,11	0,37	-0,014	-0,558
N+3.45	B83	ENVOLVENTE MAX	0	0,01	-0,32	0,009	-0,28
N+3.45	B83	ENVOLVENTE MAX	5,27	0,01	0,53	0,009	-0,259
N+3.45	B83	ENVOLVENTE MIN	0	0	-0,54	-0,01	-0,533
N+3.45	B83	ENVOLVENTE MIN	5,27	0	0,32	-0,01	-0,505
N+3.45	B84	ENVOLVENTE MAX	0	0,12	-0,36	0,016	-0,261
N+3.45	B84	ENVOLVENTE MAX	5,27	0,12	0,47	0,016	0,003
N+3.45	B84	ENVOLVENTE MIN	0	-0,11	-0,61	-0,007	-0,522
N+3.45	B84	ENVOLVENTE MIN	5,27	-0,11	0,27	-0,007	-0,229
N+3.45	B92	ENVOLVENTE MAX	0	4,59	-0,37	0,05	-0,215
N+3.45	B92	ENVOLVENTE MAX	2,64	4,59	0,17	0,05	0,347
N+3.45	B92	ENVOLVENTE MIN	0	-10,28	-0,52	0,001	-0,462
N+3.45	B92	ENVOLVENTE MIN	2,64	-10,28	-0,07	0,001	-0,246
N+3.45	B93	ENVOLVENTE MAX	0	8,55	-0,11	0,01	-0,212
N+3.45	B93	ENVOLVENTE MAX	2,64	8,55	0,24	0,01	0,648
N+3.45	B93	ENVOLVENTE MIN	0	-18,38	-0,72	-0,029	-0,718
N+3.45	B93	ENVOLVENTE MIN	2,64	-18,38	-0,26	-0,029	-0,467
N+3.45	B94	ENVOLVENTE MAX	0	8,79	-0,14	0,024	-0,204
N+3.45	B94	ENVOLVENTE MAX	2,64	8,79	0,21	0,024	0,634
N+3.45	B94	ENVOLVENTE MIN	0	-19,4	-0,7	-0,011	-0,747
N+3.45	B94	ENVOLVENTE MIN	2,64	-19,4	-0,23	-0,011	-0,443
N+3.45	B95	ENVOLVENTE MAX	0	4,56	-0,2	-0,03	-0,233
N+3.45	B95	ENVOLVENTE MAX	2,64	4,56	0,15	-0,03	0,345
N+3.45	B95	ENVOLVENTE MIN	0	-10,34	-0,52	-0,082	-0,491
N+3.45	B95	ENVOLVENTE MIN	2,64	-10,34	-0,06	-0,082	-0,232

FUERZAS EN COLUMNAS

COLUMN FORCES
UNID: kN-m

Story	Column	Load	Loc	P	V2	V3	T	M2	M3
N+3.45	C16	ENVOLVENTE MAX	0,000	-37,400	10,440	1,610	1,272	16,725	25,450
N+3.45	C16	ENVOLVENTE MAX	3,500	-19,250	10,440	1,610	1,272	32,156	18,989
N+3.45	C16	ENVOLVENTE MIN	0,000	-70,880	-11,720	-19,830	-1,229	-37,266	-22,462
N+3.45	C16	ENVOLVENTE MIN	3,500	-42,650	-11,720	-19,830	-1,229	11,079	-11,524
N+3.45	C17	ENVOLVENTE MAX	0,000	-57,460	7,830	16,010	1,272	32,740	19,432
N+3.45	C17	ENVOLVENTE MAX	3,500	-39,310	7,830	16,010	1,272	12,512	15,755
N+3.45	C17	ENVOLVENTE MIN	0,000	-95,100	-9,140	-11,560	-1,229	-27,956	-16,694
N+3.45	C17	ENVOLVENTE MIN	3,500	-66,870	-9,140	-11,560	-1,229	-23,282	-8,429
N+3.45	C18	ENVOLVENTE MAX	0,000	-32,370	8,210	17,010	1,272	33,657	20,518
N+3.45	C18	ENVOLVENTE MAX	3,500	-14,230	8,210	17,010	1,272	-3,196	16,600
N+3.45	C18	ENVOLVENTE MIN	0,000	-68,760	-9,920	-4,960	-1,229	-20,583	-18,417
N+3.45	C18	ENVOLVENTE MIN	3,500	-44,570	-9,920	-4,960	-1,229	-25,682	-8,525
N+3.45	C19	ENVOLVENTE MAX	0,000	-36,660	14,650	14,620	1,272	29,720	28,188
N+3.45	C19	ENVOLVENTE MAX	3,500	-18,510	14,650	14,620	1,272	-5,903	13,024
N+3.45	C19	ENVOLVENTE MIN	0,000	-98,820	-8,990	-2,650	-1,229	-15,234	-17,635
N+3.45	C19	ENVOLVENTE MIN	3,500	-74,730	-8,990	-2,650	-1,229	-22,481	-23,099
N+3.45	C20	ENVOLVENTE MAX	0,000	-72,530	13,800	14,230	1,272	28,300	26,492
N+3.45	C20	ENVOLVENTE MAX	3,500	-54,390	13,800	14,230	1,272	8,645	12,838
N+3.45	C20	ENVOLVENTE MIN	0,000	-119,950	-8,190	-8,780	-1,229	-22,098	-15,827
N+3.45	C20	ENVOLVENTE MIN	3,500	-91,730	-8,190	-8,780	-1,229	-21,518	-21,821
N+3.45	C21	ENVOLVENTE MAX	0,000	-44,060	17,480	-0,510	1,272	11,857	33,722
N+3.45	C21	ENVOLVENTE MAX	3,500	-25,920	17,480	-0,510	1,272	29,225	17,717
N+3.45	C21	ENVOLVENTE MIN	0,000	-93,980	-11,450	-17,400	-1,229	-31,748	-22,368
N+3.45	C21	ENVOLVENTE MIN	3,500	-67,370	-11,450	-17,400	-1,229	13,242	-27,467
N+3.45	C22	ENVOLVENTE MAX	0,000	-33,710	15,020	16,630	1,272	33,974	28,599
N+3.45	C22	ENVOLVENTE MAX	3,500	-15,570	15,020	16,630	1,272	-4,262	13,010
N+3.45	C22	ENVOLVENTE MIN	0,000	-94,070	-8,640	-4,480	-1,229	-19,974	-17,240
N+3.45	C22	ENVOLVENTE MIN	3,500	-69,880	-8,640	-4,480	-1,229	-24,274	-23,985
N+3.45	C23	ENVOLVENTE MAX	0,000	-65,660	15,160	16,900	1,272	34,279	28,051
N+3.45	C23	ENVOLVENTE MAX	3,500	-47,510	15,160	16,900	1,272	11,794	10,444
N+3.45	C23	ENVOLVENTE MIN	0,000	-110,880	-7,170	-11,240	-1,229	-27,533	-14,664
N+3.45	C23	ENVOLVENTE MIN	3,500	-82,650	-7,170	-11,240	-1,229	-24,860	-25,030
N+3.45	C24	ENVOLVENTE MAX	0,000	-38,510	18,480	1,280	1,272	16,815	34,861
N+3.45	C24	ENVOLVENTE MAX	3,500	-20,370	18,480	1,280	1,272	30,811	15,771
N+3.45	C24	ENVOLVENTE MIN	0,000	-86,270	-10,630	-18,190	-1,229	-36,404	-21,422
N+3.45	C24	ENVOLVENTE MIN	3,500	-61,120	-10,630	-18,190	-1,229	12,283	-28,811
N+3.45	C25	ENVOLVENTE MAX	0,000	-51,720	6,770	24,760	1,272	49,648	18,574
N+3.45	C25	ENVOLVENTE MAX	3,500	-33,580	6,770	24,760	1,272	-0,723	22,514
N+3.45	C25	ENVOLVENTE MIN	0,000	-96,060	-12,430	-8,620	-1,229	-30,888	-20,995
N+3.45	C25	ENVOLVENTE MIN	3,500	-69,050	-12,430	-8,620	-1,229	-37,020	-5,136
N+3.45	C26	ENVOLVENTE MAX	0,000	-88,120	1,100	23,690	1,272	48,448	11,330
N+3.45	C26	ENVOLVENTE MAX	3,500	-69,980	1,100	23,690	1,272	21,012	36,823
N+3.45	C26	ENVOLVENTE MIN	0,000	-142,840	-18,090	-17,740	-1,229	-41,083	-26,546
N+3.45	C26	ENVOLVENTE MIN	3,500	-114,620	-18,090	-17,740	-1,229	-34,454	7,443
N+3.45	C27	ENVOLVENTE MAX	0,000	-63,800	5,820	6,110	1,272	28,755	19,727
N+3.45	C27	ENVOLVENTE MAX	3,500	-45,650	5,820	6,110	1,272	40,461	34,721
N+3.45	C27	ENVOLVENTE MIN	0,000	-111,800	-18,400	-25,880	-1,229	-50,114	-28,676
N+3.45	C27	ENVOLVENTE MIN	3,500	-83,580	-18,400	-25,880	-1,229	7,354	-0,640

9.3 VERIFICACIONES

PROYECTO: MARIA INMACULADA
RESISTENCIA A CORTANTE PARA VIGAS
CHEQUEO PARA LA CONDICIÓN DESCRITA EN C.21.3.3.1 (a)

f'c = **21,1** MPa
fy = **420** MPa
$\Phi_{cortante}$ = **0,75**
Estribos Φ = **9,5** mm
Av = **71** mm^2
R= **7,00**

Mn = Momentos nominales de la viga en cada extremo restringido de la luz libre.
Vg = Cortante calculado para cargas gravitacionales mayoradas.
Vm = Cortante debido a flexion en curvatura inversa.
Vu = Vm + Vg

COMBDIS3 = 1.2C.M.+1.0C.V.+1.0Ex+0.3Ey
COMBDIS4 = 1.2C.M.+1.0C.V.+1.0(-Ex)+0.3Ey
COMBDIS5 = 1.2C.M.+1.0C.V.+1.0Ex+0.3(-Ey)
COMBDIS6 = 1.2C.M.+1.0C.V.+1.0(-Ex)+0.3(-Ey)
COMBDIS7 = 1.2C.M.+1.0C.V.+0.3Ex+1.0Ey
COMBDIS8 = 1.2C.M.+1.0C.V.+0.3(-Ex)+1.0Ey
COMBDIS9 = 1.2C.M.+1.0C.V.+0.3Ex+1.0(-Ey)
COMBDIS10 = 1.2C.M.+1.0C.V.+0.3(-Ex)+1.0(-Ey)
COMBDIS11 = 0.9C.M.+1.0Ex+0.3Ey
COMBDIS12 = 0.9C.M.+1.0(-Ex)+0.3Ey
COMBDIS13 = 0.9C.M.+1.0Ex+0.3(-Ey)
COMBDIS14 = 0.9C.M.+1.0(-Ex)+0.3(-Ey)
COMBDIS15 = 0.9C.M.+0.3Ex+1.0Ey
COMBDIS16 = 0.9C.M.+0.3(-Ex)+1.0Ey
COMBDIS17 = 0.9C.M.+0.3Ex+1.0(-Ey)
COMBDIS18 = 0.9C.M.+0.3(-Ex)+1.0(-Ey)

NIVEL	VIGA ELEMENTO No.	LOC. (m)	LONG. (m)	PROPIEDADES DEL ELEMENTO SECCION	b (m)	d (m)	M3 C.M. (KN.m)	C.V. (KN.m)	SISMO X (KN.m)	SISMO Y (KN.m)	-SISMO X (KN.m)	-SISMO Y (KN.m)
N+3.45	B1	0,000	5,270	VIG40X45	0,40	0,40	-3,512	0,001	12,976	4,839	-12,976	-4,839
	B1	5,270					-13,829	0,000	10,877	4,071	-10,877	-4,071
N+3.45	B2	0,000	5,270	VIG40X45	0,40	0,40	-9,174	0,003	8,948	3,376	-8,948	-3,376
	B2	5,270					-10,162	0,001	8,979	3,395	-8,979	-3,395
N+3.45	B3	0,000	5,270	VIG40X45	0,40	0,40	-3,501	0,003	10,808	4,019	-10,808	-4,019
	B3	5,270					-23,921	-0,002	12,743	4,686	-12,743	-4,686
N+3.45	B4	0,000	8,394	VIG40X45	0,40	0,40	-22,007	-0,051	2,886	7,723	-2,886	-7,723
	B4	8,394					-26,278	-0,451	2,654	7,131	-2,654	-7,131
N+3.45	B5	0,000	8,394	VIG40X45	0,40	0,40	-22,081	-0,075	2,445	6,671	-2,445	-6,671
	B5	8,394					-27,189	-0,899	2,170	5,883	-2,170	-5,883
N+3.45	B6	0,000	8,394	VIG40X45	0,40	0,40	-21,936	-0,073	4,141	7,759	-4,141	-7,759
	B6	8,394					-27,169	-0,858	3,730	6,931	-3,730	-6,931
N+3.45	B7	0,000	8,394	VIG40X45	0,40	0,40	-21,397	-0,047	6,182	9,833	-6,182	-9,833
	B7	8,394					-26,437	-0,435	5,740	9,194	-5,740	-9,194
N+3.45	B9	0,000	5,270	VIG40X45	0,40	0,40	-3,727	-0,010	9,170	4,140	-9,170	-4,140
	B9	5,270					-13,753	0,009	7,671	3,449	-7,671	-3,449
N+3.45	B10	0,000	5,270	VIG40X45	0,40	0,40	-9,293	0,001	6,272	2,800	-6,272	-2,800
	B10	5,270					-9,841	0,001	6,272	2,798	-6,272	-2,798
N+3.45	B11	0,000	5,270	VIG40X45	0,40	0,40	-2,468	0,009	7,672	3,461	-7,672	-3,461
	B11	5,270					-26,607	-0,012	9,172	4,173	-9,172	-4,173
N+3.45	B12	0,000	7,236	VIG40X45	0,40	0,40	-21,330	-0,130	2,941	7,817	-2,941	-7,817
	B12	7,236					-15,421	0,101	3,213	8,586	-3,213	-8,586
N+3.45	B13	0,000	7,236	VIG40X45	0,40	0,40	-21,347	-0,206	2,432	6,610	-2,432	-6,610
	B13	7,236					-15,524	0,146	2,705	7,369	-2,705	-7,369
N+3.45	B14	0,000	7,236	VIG40X45	0,40	0,40	-21,267	-0,194	4,133	7,732	-4,133	-7,732
	B14	7,236					-15,605	0,132	4,588	8,601	-4,588	-8,601
N+3.45	B15	0,000	7,236	VIG40X45	0,40	0,40	-21,612	-0,115	6,275	9,941	-6,275	-9,941
	B15	7,236					-14,820	0,086	6,910	10,966	-6,910	-10,966
N+3.45	B17	0,000	5,270	VIG40X45	0,40	0,40	-3,770	-0,001	8,232	9,273	-8,232	-9,273
	B17	5,270					-13,550	0,002	6,884	7,788	-6,884	-7,788
N+3.45	B18	0,000	5,270	VIG40X45	0,40	0,40	-9,108	0,001	5,620	6,433	-5,620	-6,433
	B18	5,270					-10,627	0,002	5,615	6,464	-5,615	-6,464
N+3.45	B19	0,000	5,270	VIG40X45	0,40	0,40	-5,496	-0,001	6,906	7,653	-6,906	-7,653
	B19	5,270					-18,877	0,005	8,297	8,905	-8,297	-8,905
N+3.45	B28	0,000	2,200	VIG20X45	0,20	0,40	-0,050	0,001	0,056	0,027	-0,056	-0,027
	B28	2,200					-0,422	-0,002	0,035	0,020	-0,035	-0,020
N+3.45	B30	0,000	2,200	VIG40X45	0,40	0,40	-0,402	-0,001	0,011	0,020	-0,011	-0,020
	B30	2,200					-0,280	0,000	0,009	0,010	-0,009	-0,010
N+3.45	B32	0,000	2,200	VIG40X45	0,40	0,40	-0,271	0,000	0,059	0,034	-0,059	-0,034
	B32	2,200					-0,537	-0,002	0,194	0,137	-0,194	-0,137
N+3.45	B36	0,000	2,200	VIG40X45	0,40	0,40	0,026	0,008	0,013	0,044	-0,013	-0,044
	B36	2,200					-0,239	0,008	0,037	0,132	-0,037	-0,132
N+3.45	B38	0,000	7,226	VIG20X45	0,20	0,40	0,041	0,017	0,025	0,080	-0,025	-0,080
	B38	7,226					-0,318	0,012	0,072	0,230	-0,072	-0,230
N+3.45	B39	0,000	8,394	VIG20X45	0,20	0,40	0,031	0,017	0,039	0,079	-0,039	-0,079
	B39	8,394					-0,284	0,010	0,117	0,236	-0,117	-0,236

VIGA ELEMENTO No.	LOC. (m)	Mn (kN.m) Combinaciones para resistencias nominales a momento COMBDIS3	COMBDIS4	COMBDIS5	COMBDIS6	COMBDIS7	COMBDIS8	COMBDIS9	COMBDIS10	COMBDIS11	COMBDIS12	COMBDIS13	COMBDIS14	COMBDIS15	COMBDIS16	COMBDIS17	COMBDIS18
B1	0,000	2,152	5,860	2,567	6,275	2,966	4,078	4,349	5,461	1,100	4,807	1,514	5,222	1,913	3,026	3,296	4,408
B1	5,270	14,866	17,974	15,215	18,323	15,547	16,479	16,710	17,643	10,718	13,825	11,067	14,174	11,398	12,331	12,562	13,494
B2	0,000	9,583	12,139	9,872	12,429	10,140	10,907	11,106	11,872	6,834	9,390	7,123	9,680	7,391	8,158	8,355	9,122
B2	5,270	10,765	13,331	11,056	13,622	11,324	12,093	12,294	13,063	7,718	10,283	8,009	10,574	8,276	9,046	9,246	10,016
B3	0,000	2,482	5,570	2,826	5,914	3,161	4,087	4,309	5,236	1,435	4,523	1,779	4,867	2,114	3,040	3,262	4,188
B3	5,270	26,686	30,327	27,088	30,728	27,492	28,584	28,831	29,923	19,508	23,149	19,909	23,550	20,313	21,406	21,652	22,744
B4	0,000	25,716	26,541	26,378	27,203	25,232	25,480	27,439	27,686	19,063	19,888	19,725	20,550	18,579	18,827	20,786	21,033
B4	8,394	31,300	32,068	31,911	32,669	30,852	31,080	32,890	33,117	22,965	23,724	23,577	24,335	22,518	22,745	24,555	24,783
B5	0,000	25,937	26,636	26,509	27,207	25,514	25,724	27,420	27,630	19,238	19,936	19,810	20,508	18,815	19,025	20,721	20,931
B5	8,394	32,964	33,584	33,468	34,088	32,592	32,778	34,273	34,459	23,908	24,528	24,412	25,032	23,537	23,723	25,218	25,404
B6	0,000	25,472	26,655	26,137	27,320	25,110	25,465	27,327	27,682	18,818	20,001	19,483	20,667	18,457	18,811	20,673	21,028
B6	8,394	32,631	33,697	33,225	34,291	32,311	32,631	34,291	34,611	23,622	24,688	24,216	25,282	23,302	23,622	25,282	25,602
B7	0,000	24,419	26,185	25,262	27,028	24,054	24,584	26,863	27,393	17,953	19,719	18,796	20,562	17,588	18,118	20,397	20,927
B7	8,394	30,945	32,585	31,733	33,373	30,600	31,092	33,227	33,719	22,579	24,219	23,367	25,007	22,234	22,726	24,861	25,353
B9	0,000	2,995	5,615	3,350	5,970	3,498	4,284	4,681	5,467	1,867	4,487	2,222	4,842	2,370	3,156	3,553	4,339
B9	5,270	15,251	17,443	15,547	17,738	15,673	16,331	16,659	17,316	11,134	13,326	11,430	13,621	11,556	12,214	12,542	13,199
B10	0,000	10,135	11,927	10,375	12,167	10,482	11,019	11,282	11,819	7,348	9,140	7,588	9,380	7,606	8,233	8,495	9,033
B10	5,270	10,792	12,584	11,032	12,824	11,140	11,677	11,939	12,477	7,841	9,633	8,081	9,873	8,188	8,726	8,988	9,525
B11	0,000	1,708	3,900	2,005	4,197	2,129	2,787	3,118	3,776	0,977	3,169	1,274	3,466	1,398	2,056	2,387	3,044
B11	5,270	30,451	33,072	30,809	33,430	30,951	31,737	32,143	32,930	22,457	25,078	22,815	25,435	22,957	23,743	24,149	24,936
B12	0,000	24,971	25,811	25,641	26,481	24,483	24,735	26,717	26,969	18,442	19,282	19,112	19,952	17,954	18,206	20,188	20,440
B12	7,236	17,577	18,495	18,313	19,231	17,040	17,315	19,493	19,768	13,052	13,970	13,788	14,706	12,515	12,790	14,968	15,243
B13	0,000	25,192	25,887	25,758	26,453	24,774	24,982	26,662	26,871	18,582	19,276	19,148	19,843	18,164	18,372	20,052	20,261
B13	7,236	17,781	18,553	18,412	19,185	17,314	17,546	19,420	19,651	13,269	14,042	13,901	14,674	12,803	13,035	14,908	15,140
B14	0,000	24,793	25,973	25,455	26,636	24,433	24,787	26,642	26,996	18,219	19,399	18,881	20,062	17,859	18,213	20,068	20,422
B14	7,236	17,570	18,881	18,307	19,618	17,169	17,562	19,626	20,019	13,020	14,331	13,758	15,069	12,619	13,012	15,077	15,470
B15	0,000	24,727	26,520	25,579	27,372	24,360	24,898	27,201	27,738	18,128	19,921	18,980	20,773	17,762	18,300	20,602	21,140
B15	7,236	16,241	18,215	17,181	19,155	15,835	16,428	18,968	19,561	11,881	13,855	12,821	14,795	11,475	12,068	14,608	15,201
B17	0,000	2,952	5,304	3,746	6,098	2,847	3,553	5,497	6,203	1,820	4,172	2,614	4,966	1,715	2,421	4,365	5,071
B17	5,270	14,941	16,908	15,608	17,575	14,850	15,440	17,076	17,666	10,878	12,845	11,545	13,512	10,787	11,377	13,013	13,603
B18	0,000	9,850	11,456	10,401	12,007	9,769	10,250	11,607	12,088	7,119	8,724	7,670	9,276	7,037	7,519	8,875	9,357
B18	5,270	11,671	13,276	12,225	13,830	11,586	12,068	13,433	13,914	8,485	10,089	9,039	10,643	8,400	8,882	10,247	10,728
B19	0,000	5,282	7,255	5,938	7,911	5,207	5,799	7,394	7,985	3,632	5,605	4,288	6,261	3,557	4,149	5,744	6,336
B19	5,270	21,080	23,451	21,844	24,214	21,020	21,731	23,564	24,275	15,422	17,793	16,186	18,556	15,362	16,073	17,906	18,617
B28	0,000	0,050	0,066	0,052	0,068	0,053	0,058	0,060	0,065	0,036	0,052	0,038	0,054	0,039	0,044	0,046	0,051
B28	2,200	0,503	0,513	0,504	0,514	0,504	0,507	0,510	0,513	0,374	0,384	0,376	0,386	0,375	0,378	0,381	0,384
B30	0,000	0,481	0,484	0,483	0,486	0,480	0,481	0,486	0,487	0,359	0,363	0,361	0,364	0,358	0,359	0,364	0,365
B30	2,200	0,334	0,337	0,335	0,338	0,334	0,335	0,337	0,338	0,250	0,253	0,251	0,254	0,250	0,251	0,253	0,254
B32	0,000	0,315	0,332	0,318	0,335	0,318	0,323	0,328	0,333	0,234	0,251	0,237	0,254	0,237	0,242	0,246	0,251
B32	2,200	0,613	0,668	0,625	0,680	0,619	0,635	0,658	0,674	0,450	0,505	0,461	0,517	0,455	0,472	0,495	0,511
B36	0,000	0,043	0,039	0,039	0,035	0,046	0,045	0,033	0,032	0,027	0,023	0,023	0,020	0,030	0,029	0,018	0,017
B36	2,200	0,268	0,278	0,279	0,290	0,258	0,262	0,296	0,299	0,204	0,215	0,215	0,226	0,195	0,198	0,232	0,236
B38	0,000	0,073	0,066	0,066	0,059	0,079	0,077	0,056	0,054	0,044	0,037	0,037	0,030	0,049	0,047	0,027	0,024
B38	7,226	0,349	0,370	0,369	0,390	0,334	0,340	0,399	0,406	0,266	0,287	0,286	0,306	0,250	0,256	0,316	0,322
B39	0,000	0,063	0,052	0,056	0,045	0,067	0,064	0,045	0,041	0,037	0,026	0,030	0,019	0,041	0,038	0,018	0,015
B39	8,394	0,304	0,337	0,324	0,358	0,292	0,302	0,360	0,370	0,229	0,262	0,249	0,282	0,217	0,227	0,284	0,294

PROYECTO: MARIA INMACULADA
RESISTENCIA A CORTANTE PARA VIGAS
CHEQUEO PARA LA CONDICIÓN DESCRITA EN C.21.3.3.1 (a)

f'c = **21,1** MPa
fy = **420** MPa
$\Phi_{Cortante}$ = **0,75**
Estribos Φ = **9,5** mm
Av = **71** mm^2
R= **7,00**

Mn = Momentos nominales de la viga en cada extremo restringido de la luz libre.
Vg = Cortante calculado para cargas gravitacionales mayoradas.
Vm = Cortante debido a flexion en curvatura inversa.
Vu = Vm + Vg

V_g	$V_m = M_{nl} + M_{nr} / l_n$															
	COMBDIS3	COMBDIS4	COMBDIS5	COMBDIS6	COMBDIS7	COMBDIS8	COMBDIS9	COMBDIS10	COMBDIS11	COMBDIS12	COMBDIS13	COMBDIS14	COMBDIS15	COMBDIS16	COMBDIS17	COMBDIS18
(kN)	(kN)															
11,316 16,008	3,229	4,523	3,374	4,667	3,513	3,901	3,996	4,384	2,242	3,536	2,387	3,681	2,526	2,914	3,009	3,397
13,440 13,884	3,861	4,833	3,971	4,943	4,073	4,364	4,440	4,731	2,761	3,733	2,871	3,843	2,973	3,264	3,340	3,631
9,012 18,312	5,535	6,812	5,676	6,953	5,816	6,199	6,288	6,671	3,974	5,251	4,115	5,392	4,256	4,639	4,728	5,111
21,140 28,288	6,792	6,981	6,944	7,133	6,682	6,738	7,187	7,244	5,007	5,196	5,159	5,347	4,896	4,953	5,402	5,458
21,208 33,344	7,017	7,174	7,145	7,302	6,922	6,970	7,350	7,397	5,140	5,297	5,268	5,425	5,045	5,093	5,473	5,520
21,172 33,004	6,922	7,190	7,072	7,340	6,841	6,921	7,341	7,421	5,056	5,324	5,206	5,474	4,975	5,055	5,475	5,555
21,020 28,092	6,596	7,001	6,790	7,196	6,511	6,633	7,159	7,280	4,829	5,234	5,023	5,429	4,744	4,866	5,392	5,513
11,376 15,948	3,462	4,375	3,586	4,499	3,638	3,912	4,049	4,323	2,467	3,380	2,590	3,503	2,643	2,916	3,054	3,328
13,536 13,788	3,971	4,651	4,062	4,742	4,103	4,307	4,406	4,610	2,882	3,562	2,973	3,653	3,014	3,218	3,317	3,521
8,160 19,152	6,102	7,016	6,227	7,140	6,277	6,551	6,691	6,965	4,447	5,360	4,571	5,484	4,621	4,895	5,035	5,309
19,788 17,724	5,880	6,123	6,074	6,317	5,738	5,811	6,386	6,459	4,352	4,595	4,547	4,790	4,211	4,284	4,858	4,931
19,796 17,716	5,939	6,142	6,104	6,307	5,816	5,877	6,368	6,429	4,402	4,605	4,567	4,770	4,280	4,340	4,832	4,892
19,772 17,740	5,854	6,199	6,048	6,392	5,749	5,853	6,394	6,497	4,317	4,662	4,511	4,855	4,212	4,315	4,857	4,960
19,932 17,580	5,662	6,182	5,909	6,430	5,555	5,711	6,380	6,537	4,147	4,668	4,395	4,915	4,040	4,197	4,866	5,022
11,436 15,888	3,395	4,215	3,673	4,492	3,358	3,604	4,283	4,529	2,409	3,229	2,687	3,506	2,372	2,618	3,297	3,543
13,308 14,004	4,084	4,693	4,293	4,903	4,052	4,235	4,751	4,934	2,961	3,570	3,171	3,780	2,929	3,112	3,629	3,811
10,608 16,704	5,002	5,827	5,272	6,096	4,977	5,224	5,874	6,122	3,616	4,440	3,885	4,709	3,590	3,837	4,488	4,735
0,372 0,540	0,251	0,263	0,253	0,265	0,253	0,257	0,259	0,263	0,186	0,198	0,188	0,200	0,188	0,192	0,194	0,198
0,492 0,432	0,371	0,373	0,372	0,374	0,370	0,371	0,374	0,375	0,277	0,280	0,278	0,281	0,277	0,277	0,281	0,281
0,396 0,516	0,422	0,455	0,429	0,461	0,426	0,435	0,448	0,458	0,311	0,344	0,317	0,350	0,315	0,324	0,337	0,347
0,048 0,336	0,141	0,144	0,145	0,148	0,138	0,139	0,150	0,151	0,105	0,108	0,109	0,112	0,102	0,103	0,114	0,115
0,000 0,384	0,058	0,060	0,060	0,062	0,057	0,058	0,063	0,064	0,043	0,045	0,045	0,047	0,041	0,042	0,047	0,048
0,024 0,360	0,044	0,046	0,045	0,048	0,043	0,044	0,048	0,049	0,032	0,034	0,033	0,036	0,031	0,032	0,036	0,037

PROYECTO: MARIA INMACULADA
RESISTENCIA A CORTANTE PARA VIGAS
CHEQUEO PARA LA CONDICIÓN DESCRITA EN C.21.3.3.1 (a)

f'c =	21.1	MPa
fy =	420	MPa
$\Phi_{Cortante}$ =	0.75	
Estribos Φ =	9.5	mm
Av =	71	mm^2
R=	7.00	

Mn = Momentos nominales de la viga en cada extremo restringido de la luz libre.
Vg = Cortante calculado para cargas gravitacionales mayoradas.
Vm = Cortante debido a flexion en curvatura inversa.
Vu = Vm + Vg

Vu = Vm + Vg (kN)																Vu_{max} (kN)	S (m)	ΦVs (kN)	ΦVc (kN)	ΦVn (kN)	ΦVn > Vu_{max}
COMBDIS3	COMBDIS4	COMBDIS5	COMBDIS6	COMBDIS7	COMBDIS8	COMBDIS9	COMBDIS10	COMBDIS11	COMBDIS12	COMBDIS13	COMBDIS14	COMBDIS15	COMBDIS16	COMBDIS17	COMBDIS18						
14.545	15.839	14.690	15.983	14.829	15.217	15.312	15.700	13.558	14.852	13.703	14.997	13.842	14.230	14.325	14.713	16.0	0.10	178.92	91.87	270.79	OK
16.008	16.008	16.008	16.008	16.008	16.008	16.008	16.008	16.008	16.008	16.008	16.008	16.008	16.008	16.008	16.008						
17.301	18.273	17.411	18.383	17.513	17.804	17.880	18.171	16.201	17.173	16.311	17.283	16.413	16.704	16.780	17.071	18.4	0.10	178.92	91.87	270.79	OK
13.884	13.884	13.884	13.884	13.884	13.884	13.884	13.884	13.884	13.884	13.884	13.884	13.884	13.884	13.884	13.884						
14.547	15.824	14.688	15.965	14.828	15.211	15.300	15.683	12.986	14.263	13.127	14.404	13.268	13.651	13.740	14.123	18.3	0.10	178.92	91.87	270.79	OK
18.312	18.312	18.312	18.312	18.312	18.312	18.312	18.312	18.312	18.312	18.312	18.312	18.312	18.312	18.312	18.312						
27.932	28.121	28.084	28.273	27.822	27.878	28.327	28.384	26.147	26.336	26.299	26.487	26.036	26.093	26.542	26.598	28.4	0.10	178.92	91.87	270.79	OK
28.288	28.288	28.288	28.288	28.288	28.288	28.288	28.288	28.288	28.288	28.288	28.288	28.288	28.288	28.288	28.288						
28.225	28.382	28.353	28.510	28.130	28.178	28.558	28.605	26.348	26.505	26.476	26.633	26.253	26.301	26.681	26.728	33.3	0.10	178.92	91.87	270.79	OK
33.344	33.344	33.344	33.344	33.344	33.344	33.344	33.344	33.344	33.344	33.344	33.344	33.344	33.344	33.344	33.344						
28.094	28.362	28.244	28.512	28.013	28.093	28.513	28.593	26.228	26.496	26.378	26.646	26.147	26.227	26.647	26.727	33.0	0.10	178.92	91.87	270.79	OK
33.004	33.004	33.004	33.004	33.004	33.004	33.004	33.004	33.004	33.004	33.004	33.004	33.004	33.004	33.004	33.004						
27.616	28.021	27.810	28.216	27.531	27.653	28.179	28.300	25.849	26.254	26.043	26.449	25.764	25.886	26.412	26.533	28.3	0.10	178.92	91.87	270.79	OK
28.092	28.092	28.092	28.092	28.092	28.092	28.092	28.092	28.092	28.092	28.092	28.092	28.092	28.092	28.092	28.092						
14.838	15.751	14.962	15.875	15.014	15.288	15.425	15.699	13.843	14.756	13.966	14.879	14.019	14.292	14.430	14.704	15.9	0.10	178.92	91.87	270.79	OK
15.948	15.948	15.948	15.948	15.948	15.948	15.948	15.948	15.948	15.948	15.948	15.948	15.948	15.948	15.948	15.948						
17.507	18.187	17.598	18.278	17.639	17.843	17.942	18.146	16.418	17.098	16.509	17.189	16.550	16.754	16.853	17.057	18.3	0.10	178.92	91.87	270.79	OK
13.788	13.788	13.788	13.788	13.788	13.788	13.788	13.788	13.788	13.788	13.788	13.788	13.788	13.788	13.788	13.788						
14.262	15.176	14.387	15.300	14.437	14.711	14.851	15.125	12.607	13.520	12.731	13.644	12.781	13.055	13.195	13.469	19.2	0.10	178.92	91.87	270.79	OK
19.152	19.152	19.152	19.152	19.152	19.152	19.152	19.152	19.152	19.152	19.152	19.152	19.152	19.152	19.152	19.152						
25.668	25.911	25.862	26.105	25.526	25.599	26.174	26.247	24.140	24.383	24.335	24.578	23.999	24.072	24.646	24.719	26.2	0.10	178.92	91.87	270.79	OK
17.724	17.724	17.724	17.724	17.724	17.724	17.724	17.724	17.724	17.724	17.724	17.724	17.724	17.724	17.724	17.724						
25.735	25.938	25.900	26.103	25.612	25.673	26.164	26.225	24.198	24.401	24.363	24.566	24.076	24.136	24.628	24.688	26.2	0.10	178.92	91.87	270.79	OK
17.716	17.716	17.716	17.716	17.716	17.716	17.716	17.716	17.716	17.716	17.716	17.716	17.716	17.716	17.716	17.716						
25.626	25.971	25.820	26.164	25.521	25.625	26.166	26.269	24.089	24.434	24.283	24.627	23.984	24.087	24.629	24.732	26.3	0.10	178.92	91.87	270.79	OK
17.740	17.740	17.740	17.740	17.740	17.740	17.740	17.740	17.740	17.740	17.740	17.740	17.740	17.740	17.740	17.740						
25.594	26.114	25.841	26.362	25.487	25.643	26.312	26.469	24.079	24.600	24.327	24.847	23.972	24.129	24.798	24.954	26.5	0.10	178.92	91.87	270.79	OK
17.580	17.580	17.580	17.580	17.580	17.580	17.580	17.580	17.580	17.580	17.580	17.580	17.580	17.580	17.580	17.580						
14.831	15.651	15.109	15.928	14.794	15.040	15.719	15.965	13.845	14.665	14.123	14.942	13.808	14.054	14.733	14.979	16.0	0.10	178.92	91.87	270.79	OK
15.888	15.888	15.888	15.888	15.888	15.888	15.888	15.888	15.888	15.888	15.888	15.888	15.888	15.888	15.888	15.888						
17.392	18.001	17.601	18.211	17.360	17.543	18.059	18.242	16.269	16.878	16.479	17.088	16.237	16.420	16.937	17.119	18.2	0.10	178.92	91.87	270.79	OK
14.004	14.004	14.004	14.004	14.004	14.004	14.004	14.004	14.004	14.004	14.004	14.004	14.004	14.004	14.004	14.004						
15.610	16.435	15.880	16.704	15.585	15.832	16.482	16.730	14.224	15.048	14.493	15.317	14.198	14.445	15.096	15.343	16.7	0.10	178.92	91.87	270.79	OK
16.704	16.704	16.704	16.704	16.704	16.704	16.704	16.704	16.704	16.704	16.704	16.704	16.704	16.704	16.704	16.704						
0.623	0.635	0.625	0.637	0.625	0.629	0.631	0.635	0.558	0.570	0.560	0.572	0.560	0.564	0.566	0.570	0.6	0.10	178.92	45.93	224.85	OK
0.540	0.540	0.540	0.540	0.540	0.540	0.540	0.540	0.540	0.540	0.540	0.540	0.540	0.540	0.540	0.540						
0.863	0.865	0.864	0.866	0.862	0.863	0.866	0.867	0.769	0.772	0.770	0.773	0.769	0.769	0.773	0.773	0.9	0.10	178.92	91.87	270.79	OK
0.432	0.432	0.432	0.432	0.432	0.432	0.432	0.432	0.432	0.432	0.432	0.432	0.432	0.432	0.432	0.432						
0.818	0.851	0.825	0.857	0.822	0.831	0.844	0.854	0.707	0.740	0.713	0.746	0.711	0.720	0.733	0.743	0.9	0.10	178.92	91.87	270.79	OK
0.516	0.516	0.516	0.516	0.516	0.516	0.516	0.516	0.516	0.516	0.516	0.516	0.516	0.516	0.516	0.516						
0.189	0.192	0.193	0.196	0.186	0.187	0.198	0.199	0.153	0.156	0.157	0.160	0.150	0.151	0.162	0.163	0.3	0.10	178.92	91.87	270.79	OK
0.336	0.336	0.336	0.336	0.336	0.336	0.336	0.336	0.336	0.336	0.336	0.336	0.336	0.336	0.336	0.336						
0.058	0.060	0.060	0.062	0.057	0.058	0.063	0.064	0.043	0.045	0.045	0.047	0.041	0.042	0.047	0.048	0.4	0.10	178.92	45.93	224.85	OK
0.384	0.384	0.384	0.384	0.384	0.384	0.384	0.384	0.384	0.384	0.384	0.384	0.384	0.384	0.384	0.384						
0.068	0.070	0.069	0.072	0.067	0.068	0.072	0.073	0.056	0.058	0.057	0.060	0.055	0.056	0.060	0.061	0.4	0.10	178.92	45.93	224.85	OK
0.360	0.360	0.360	0.360	0.360	0.360	0.360	0.360	0.360	0.360	0.360	0.360	0.360	0.360	0.360	0.360						

PROYECTO: MARIA INMACULADA
RESISTENCIA A CORTANTE PARA VIGAS
CHEQUEO PARA LA CONDICIÓN DESCRITA EN C.21.3.3.1 (b)

f'c = 21,0 MPa
fy = 420 MPa
$\Phi_{Cortante}$ = 0,75
Estribos Φ = 9,5 mm
Av = 71 mm²
R= 7,00

2VE = Cortante maximo obtenido de las combinaciones de carga de diseño que incluyan E, considerando E, como el doble del prescrito por el reglamento general legalmente adoptado para diseño sismico vigente.

COMBDIS3 = 1.2C.M.+1.0C.V.+(2*(1.0Ex))+(2*(0.3Ey))
COMBDIS4 = 1.2C.M.+1.0C.V.+(2*(1.0(-Ex)))+(2*(0.3Ey))
COMBDIS5 = 1.2C.M.+1.0C.V.+(2*(1.0Ex))+(2*(0.3(-Ey)))
COMBDIS6 = 1.2C.M.+1.0C.V.+(2*(1.0(-Ex)))+(2*(0.3(-Ey)))
COMBDIS7 = 1.2C.M.+1.0C.V.+(2*(0.3Ex))+(2*(1.0Ey))
COMBDIS8 = 1.2C.M.+1.0C.V.+(2*(0.3(-Ex)))+(2*(1.0Ey))
COMBDIS9 = 1.2C.M.+1.0C.V.+(2*(0.3Ex))+(2*(1.0(-Ey)))
COMBDIS10 = 1.2C.M.+1.0C.V.+(2*(0.3(-Ex)))+(2*(1.0(-Ey)))
COMBDIS11 = 0.9C.M.+(2*(1.0Ex))+(2*(0.3Ey))
COMBDIS12 = 0.9C.M.+(2*(1.0(-Ex)))+(2*(0.3Ey))
COMBDIS13 = 0.9C.M.+(2*(1.0Ex))+(2*(0.3(-Ey)))
COMBDIS14 = 0.9C.M.+(2*(1.0(-Ex)))+(2*(0.3(-Ey)))
COMBDIS15 = 0.9C.M.+(2*(0.3Ex))+(2*(1.0Ey))
COMBDIS16 = 0.9C.M.+(2*(0.3(-Ex)))+(2*(1.0Ey))
COMBDIS17 = 0.9C.M.+(2*(0.3Ex))+(2*(1.0(-Ey)))
COMBDIS17 = 0.9C.M.+(2*(0.3(-Ex)))+(2*(1.0(-Ey)))

NIVEL	VIGA	LOC.	LONG.	PROPIEDADES DEL ELEMENTO			V2						2Ve																$2V_{E max}$	S	ΦVs	ΦVc	ΦVn	$\Phi Vn > 2V_{Emax}$
	ELEMENTO			SECCION	b	d	C.M.	C.V.	SISMO X	SISMO Y	-SISMO X	-SISMO Y	Combinaciones de carga de diseño para el doble del cortante donde se incluya E																					
	No.	(m)	(m)		(m)	(m)	(KN.m)	(KN.m)	(KN.m)	(KN.m)	(KN.m)	(KN.m)	COMBDIS3	COMBDIS4	COMBDIS5	COMBDIS6	COMBDIS7	COMBDIS8	COMBDIS9	COMBDIS10	COMBDIS11	COMBDIS12	COMBDIS13	COMBDIS14	COMBDIS15	COMBDIS16	COMBDIS17	COMBDIS18	(kN)	(m)	(kN)	(kN)	(kN)	
N+3.45	B1	0	5,27	VIGA40X40	0,40	0,40	-9,43	0	9,06	3,38	0	0	9,877	11,171	10,022	11,316	10,440	10,833	10,928	11,316	7,048	8,342	7,193	8,487	7,618	8,004	8,099	8,487	17,4	0,10	178,92	91,65	270,57	OK
	B1	5,27					13,34	0	9,06	3,38	0	0	17,447	16,153	17,302	16,008	15,979	16,491	16,396	16,008	12,445	12,151	12,300	12,006	12,077	12,489	12,394	12,006						
N+3.45	B2	0	5,27	VIGA40X40	0,40	0,40	-11,2	0	6,6	2,56	0	0	12,359	13,330	12,469	13,440	12,760	13,074	13,149	13,440	8,999	9,970	9,109	10,080	9,423	9,714	9,789	10,080	15,0	0,10	178,92	91,65	270,57	OK
	B2	5,27					11,57	0	6,6	2,56	0	0	14,965	13,994	14,855	13,884	14,541	14,250	14,175	13,884	11,494	10,523	11,384	10,413	11,070	10,779	10,704	10,413						
N+3.45	B3	0	5,27	VIGA40X40	0,40	0,40	-7,51	0	8,94	3,3	0	0	7,593	8,871	7,735	9,012	8,157	8,541	8,629	9,012	5,340	6,618	5,482	6,759	5,904	6,288	6,376	6,759	19,7	0,10	178,92	91,65	270,57	OK
	B3	5,27					15,26	0	8,94	3,3	0	0	19,731	18,453	19,589	18,312	19,157	18,783	18,695	18,312	15,153	13,875	15,011	13,734	14,589	14,205	14,117	13,734						
N+3.45	B4	0	8,394	VIGA40X40	0,40	0,40	-17,59	-0,02	1,3	2,48	-0,02	-0,04	20,790	20,982	20,944	21,133	20,575	20,632	21,078	21,135	15,496	15,686	15,647	15,836	15,278	15,335	15,781	15,838	28,3	0,10	178,92	91,65	270,57	OK
	B4	8,394					21,04	1,3	2	4,06	-0,14	-0,58	27,909	27,663	27,769	27,463	28,246	28,153	27,511	27,419	20,137	19,831	19,617	19,611	20,393	20,301	19,659	19,567						
N+3.45	B5	0	8,394	VIGA40X40	0,40	0,40	-17,62	-0,04	1,1	3	-0,02	-0,08	20,898	21,058	21,030	21,190	20,708	20,738	21,148	21,196	15,572	15,732	15,704	15,864	15,382	15,480	15,822	15,870	32,5	0,10	178,92	91,65	270,57	OK
	B5	8,394					24,52	1,45	1,52	4,18	-0,28	-0,96	33,270	33,018	33,050	32,796	32,538	32,492	31,803	31,726	22,464	22,210	22,244	21,990	22,730	22,654	21,998	21,920						
N+3.45	B6	0	8,394	VIGA40X40	0,40	0,40	-17,59	-0,04	1,66	3,48	-0,02	-0,08	20,733	21,002	20,886	21,154	20,571	20,652	21,080	21,160	15,418	15,686	15,569	15,837	15,254	15,335	15,763	15,843	32,4	0,10	178,92	91,65	270,57	OK
	B6	8,394					24,33	2,38	2,62	4,08	-0,4	-0,94	32,159	31,728	31,910	31,479	32,305	32,238	31,554	31,425	22,480	22,049	22,231	21,800	22,706	22,577	21,875	21,746						
N+3.45	B7	0	8,394	VIGA40X40	0,40	0,40	-17,49	-0,02	2,78	4,42	-0,02	-0,04	20,421	20,821	20,613	21,013	20,257	20,377	20,895	21,015	15,154	15,554	15,346	15,746	14,990	15,110	15,628	15,748	28,4	0,10	178,92	91,65	270,57	OK
	B7	8,394					21,73	1,26	3,76	6,14	-0,26	-0,5	28,136	27,562	27,802	27,277	28,374	28,202	27,426	27,253	20,357	19,783	20,073	19,498	20,595	20,423	19,647	19,474						
N+3.45	B9	0	5,27	VIGA40X40	0,40	0,40	-9,46	0	6,4	2,08	0	0	10,338	11,153	10,462	11,276	10,690	10,965	11,153	11,276	7,494	8,409	7,618	8,532	7,846	8,121	8,208	8,532	17,0	0,10	178,92	91,65	270,57	OK
	B9	5,27					13,29	0	6,4	2,08	0	0	16,986	16,071	16,862	15,948	16,634	16,359	16,233	15,948	12,999	12,084	12,875	11,961	12,647	12,373	12,235	11,961						
N+3.45	B10	0	5,27	VIGA40X40	0,40	0,40	-11,28	0	4,76	2,12	0	0	12,760	13,445	12,856	13,536	13,029	13,233	13,333	13,536	9,381	10,061	9,473	10,152	9,646	9,849	9,946	10,152	14,6	0,10	178,92	91,65	270,57	OK
	B10	5,27					11,49	0	4,76	2,12	0	0	14,559	13,879	14,468	13,788	14,295	14,091	13,993	13,788	11,112	10,432	11,021	10,341	10,848	10,644	10,546	10,341						
N+3.45	B11	0	5,27	VIGA40X40	0,40	0,40	-6,8	0	6,4	2,9	0	0	7,121	8,036	7,246	8,160	7,471	7,746	7,886	8,160	5,081	5,996	5,206	6,120	5,431	5,706	5,846	6,120	20,2	0,10	178,92	91,65	270,57	OK
	B11	5,27					15,96	0	6,4	2,9	0	0	20,191	19,276	20,066	19,152	19,841	19,566	19,426	19,152	15,403	14,488	15,278	14,364	15,053	14,778	14,638	14,364						
N+3.45	B12	0	7,226	VIGA40X40	0,40	0,40	-16,45	-0,02	1,7	4,54	0	0	19,333	19,575	19,527	19,770	19,049	19,121	19,697	19,770	14,358	14,610	14,562	14,805	14,084	14,156	14,732	14,805	19,8	0,10	178,92	91,65	270,57	OK
	B12	7,226					14,81	-0,02	1,7	4,54	0	0	18,179	17,937	17,985	17,742	18,463	18,396	17,815	17,742	13,766	13,324	13,572	13,329	14,058	13,678	12,403	13,329						
N+3.45	B13	0	7,226	VIGA40X40	0,40	0,40	-16,42	-0,05	1,42	2,06	0	0	19,298	19,601	19,363	19,796	19,154	19,215	19,725	19,766	14,419	14,622	14,584	14,787	14,175	14,226	14,726	14,787	19,8	0,10	178,92	91,65	270,57	OK
	B13	7,226					14,83	-0,05	1,42	2,06	0	0	18,114	17,911	17,949	17,746	18,358	18,297	17,807	17,746	13,715	13,512	13,558	13,347	13,959	13,898	12,408	13,347						
N+3.45	B14	0	7,226	VIGA40X40	0,40	0,40	-16,41	-0,05	2,42	4,02	0	0	18,303	19,946	19,396	19,742	18,963	18,096	19,638	19,742	14,230	14,575	14,422	14,769	14,020	14,123	14,665	14,769	19,7	0,10	178,92	91,65	270,57	OK
	B14	7,226					14,83	-0,05	2,42	4,02	0	0	18,309	17,964	18,116	17,770	18,519	18,416	17,874	17,770	13,904	13,559	13,711	13,365	14,114	14,011	12,469	13,365						
N+3.45	B15	0	7,226	VIGA40X40	0,40	0,40	-16,57	-0,02	3,64	5,78	0	0	19,146	19,666	19,394	19,914	18,932	19,088	19,758	19,914	14,145	14,665	14,393	14,913	13,931	14,087	14,757	14,913	19,9	0,10	178,92	91,65	270,57	OK
	B15	7,226					14,69	-0,02	3,64	5,78	0	0	18,366	17,846	18,118	17,598	18,580	18,424	17,754	17,598	13,989	13,469	13,741	13,221	14,203	14,047	13,377	13,221						
N+3.45	B17	0	5,27	VIGA40X40	0,40	0,40	-9,53	0	5,74	6,48	0	0	10,338	11,158	10,616	11,436	10,264	10,510	11,190	11,436	7,479	8,299	7,757	8,577	7,405	7,651	8,331	8,577	17,1	0,10	178,92	91,65	270,57	OK
	B17	5,27					13,34	0	5,74	6,48	0	0	16,986	16,166	16,708	15,888	17,060	16,814	16,134	15,888	13,014	12,194	12,736	11,916	13,088	12,842	12,162	11,916						
N+3.45	B18	0	5,27	VIGA40X40	0,40	0,40	-11,09	0	4,26	4,9	0	0	12,469	13,098	12,699	13,300	12,425	12,608	13,125	13,300	9,162	9,771	9,373	9,981	9,098	9,281	9,798	9,981	14,9	0,10	178,92	91,65	270,57	OK
	B18	5,27					11,67	0	4,26	4,9	0	0	14,623	14,214	14,613	14,004	14,087	14,704	14,187	14,004	11,322	10,713	11,112	10,503	11,386	11,203	10,686	10,503						
N+3.45	B19	0	5,27	VIGA40X40	0,40	0,40	-8,64	0	5,76	6,28	0	0	9,516	10,339	9,765	10,608	9,464	9,711	10,261	10,608	6,694	7,667	7,133	7,956	6,812	7,059	7,709	7,956	17,8	0,10	178,92	91,65	270,57	OK
	B19	5,27					13,92	0	5,76	6,28	0	0	17,798	16,973	17,527	16,704	17,848	17,601	16,951	16,704	13,620	12,797	13,351	12,528	13,672	13,425	12,775	12,528						
N+3.45	B28	0	2,2	VIGA20X40	0,20	0,40	0,11	0	0,3	0,34	0	0	0,109	0,147	0,175	0,133	0,183	0,181	0,145	0,132	0,158	0,114	0,142	0,099	0,180	0,148	0,112	0,099	5,9	0,10	178,92	45,83	224,75	OK
	B28	2,2					4,66	0	0,3	0,34	0	0	5,809	5,847	5,875	5,832	5,863	5,861	5,845	5,832	4,421	4,399	4,417	4,374	4,435	4,423	4,387	4,374						
N+3.45	B30	0	2,2	VIGA40X40	0,40	0,40	-23,03	0	0,92	1,26	0	0	27,451	27,583	27,505	27,636	27,417	27,456	27,597	27,636	20,543	20,673	20,596	20,727	20,508	20,547	20,688	20,727	27,6	0,10	178,92	91,65	270,57	OK
	B30	2,2					-13,52	0	0,92	1,26	0	0	16,039	16,170	16,093	16,224	16,005	16,044	16,185	16,224	11,983	12,114	12,037	12,168	11,949	11,988	12,129	12,168						
N+3.45	B32	0	2,2	VIGA40X40	0,40	0,40	-16,47	0	0,64	1,02	0	0	19,629	19,720	19,673	19,764	19,591	19,618	19,737	19,764	14,688	14,779	14,732	14,822	14,650	14,677	14,796	14,823	19,8	0,10	178,92	91,65	270,57	OK
	B32	2,2					-6,97	0	0,64	1,02	0	0	8,229	8,320	8,273	8,364	8,191	8,218	8,337	8,364	6,128	6,229	6,182	6,273	6,100	6,127	6,246	6,273						
N+3.45	B36	0	2,2	VIGA40X40	0,40	0,40	-27,61	0	0,1	0,12	0	0	33,113	33,127	33,118	33,132	33,111	33,115	33,128	33,132	24,830	24,844	24,835	24,849	24,828	24,832	24,845	24,849	33,1	0,10	178,92	91,65	270,57	OK
	B36	2,2					-18,11	0	0,1	0,12	0	0	21,713	21,727	21,718	21,732	21,711	21,715	21,728	21,732	16,280	16,294	16,285	16,299	16,278	16,282	16,295	16,299						
N+3.45	B38	0	7,226	VIGA20X40	0,20	0,40	-6,97	0	0,64	1,02	0	0	8,229	8,320	8,273	8,364	8,191	8,218	8,337	8,364	6,128	6,229	6,162	6,273	6,100	6,127	6,246	6,273	10,5	0,10	178,92	45,83	224,75	OK
	B38	7,226					8,64	0	0,64	1,02	0	0	10,503	10,412	10,459	10,368	10,541	10,514	10,395	10,368	7,911	7,820	7,867	7,776	7,949	7,922	7,803	7,776						
N+3.45	B39	0	8,394	VIGA20X40	0,20	0,40	-9,47	0	0,62	0,92	0	0	11,226	11,325	11,275	11,364	11,206	11,233	11,337	11,364	8,395	8,484	8,434	8,523	8,365	8,392	8,496	8,523	11,4	0,10	178,92	45,83	224,75	OK
	B39	8,394					8,66	0	0,62	0,92	0	0	10,526	10,431	10,481	10,392	10,550	10,523	10,419	10,392	7,922	7,833	7,883	7,794	7,962	7,935	7,831	7,794						

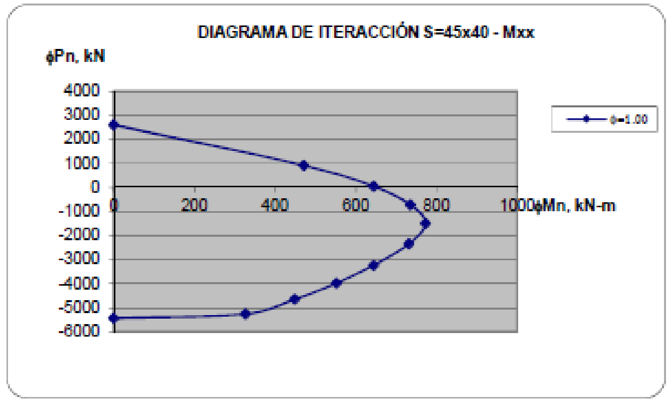
PROYECTO: MARIA INMACULADA
RESISTENCIA A CORTANTE PARA COLUMNAS
CHEQUEO PARA LA CONDICIÓN DESCRITA EN C.21.3.3.2 (a) - COLUMNA S=40X60 (12/#7 #6 (1.7%))

f'c =	21,1	MPa	Estribos Φ =	9,5	mm
fy =	420	MPa	Av =	71	mm^2
$\Phi_{Cortante}$ =	0,75		Cantidad de ramas =	4	
bx =	0,40	m	S =	0,10	m
by =	0,60	m	Recub. =	0,05	m
Lcol =	3,50	m			

C.21.3.3.2(a) El cortante ΦVn no debe ser menor que la suma del cortante debido a flexión en curvatura inversa asociado con el desarrollo de los momentos nominales de la columna en cada extremo restringido de la longitud libre.

DATOS PARA LOS DIAGRAMAS DE ITERACCIÓN

No.	Curve 1	0. degrees	
	P	M3	M2
1	-5437,00	0,00	0,00
2	-5266,00	325,93	0,00
3	-4645,00	448,75	0,00
4	-3982,00	551,99	0,00
5	-3237,00	643,41	0,00
6	-2348,00	731,49	0,00
7	-1501,00	772,33	0,00
8	-726,17	735,33	0,00
9	45,74	643,98	0,00
10	914,17	470,82	0,00
11	2601,29	0,00	0,00

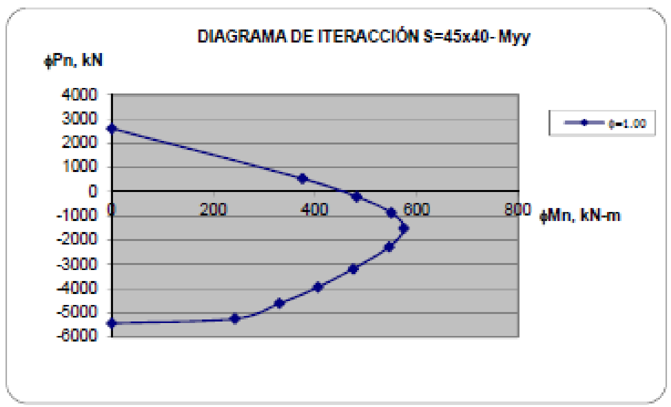


P_{ua} =	127,44	kN
P_{ub} =	103,24	kN
ΦM_{na} =	487,11	kN-m
ΦM_{nb} =	482,29	kN-m
$V_{umáx}$ =	276,97	kN
ΦV_s =	469,67	kN
ΦV_c =	120,58	kN
ΦV_n =	590,24	kN

$\Phi V_n > V_{umáx}$ = OK

DATOS PARA LOS DIAGRAMAS DE ITERACCIÓN

No.	Curve 7	90. degrees	
	P	M3	M2
1	-5437,00	0,00	0,00
2	-5250,00	0,00	242,72
3	-4624,00	0,00	329,83
4	-3943,00	0,00	406,10
5	-3188,00	0,00	475,09
6	-2284,00	0,00	545,89
7	-1519,00	0,00	574,34
8	-876,01	0,00	549,63
9	-213,88	0,00	482,37
10	535,09	0,00	375,63
11	2601,29	0,00	0,00



P_{ua} =	126,04	kN
P_{ub} =	101,85	kN
ΦM_{na} =	424,07	kN-m
ΦM_{nb} =	420,63	kN-m
$V_{umáx}$ =	241,34	kN
ΦV_s =	492,03	kN
ΦV_c =	126,32	kN
ΦV_n =	618,35	kN

$\Phi V_n > V_{umáx}$ = OK

PROYECTO: MARIA INMACULADA
RESISTENCIA A CORTANTE PARA COLUMNAS
CHEQUEO PARA LA CONDICIÓN DESCRITA EN C.21.3.3.2 (b)

f'c =	21,1	MPa	Estribos Φ =	9,5	mm
fy =	420	MPa	Av =	71	mm^2
$\Phi_{Cortante}$ =	0,75		Cantidad de ramas =	4	
bx =	0,40	m	S =	0,10	m
by =	0,60	m	Ω_o=	3,00	
			Recub. =	0,05	m

C.21.3.3.2(b) El cortante ΦVn no debe ser menor que el cortante maximo obtenido de la que incluyan E, con E incrementado por medio de Ωo.

Para cortante V2

Ω_o*$V_{umáx}$ =	46,46	kN
ΦV_s =	469,67	kN
ΦV_c =	120,58	kN
ΦV_n =	590,24	kN
$\Phi V_n > \Omega_o$*$V_{umáx}$ =	OK	

Para cortante V3

Ω_o*$V_{umáx}$ =	64,17	kN
ΦV_s =	492,03	kN
ΦV_c =	126,32	kN
ΦV_n =	618,35	kN
$\Phi V_n > \Omega_o$*$V_{umáx}$ =	OK	

10 BIBLIOGRAFIA

- Norma Colombiana de Diseño y Construcción Sismo Resistente Ley 400 de 1997 (Modificada Ley 1229 de 2008) y Decreto 926 de Marzo de 2010, Decreto 092 del 17 de Enero de 2011, Decreto 0340 del 13 de Febrero de 2012
- Reglamento para Concreto Estructural ACI 318S-08.

ELABORACIÓN DE DIAGNÓSTICOS, ESTUDIOS TÉCNICOS, AJUSTES A DISEÑOS O DISEÑOS INTEGRALES, CONSTRUCCIÓN Y PUESTA EN FUNCIONAMIENTO DE LAS OBRAS DE INFRAESTRUCTURA EDUCATIVA – UBICADAS EN EL DEPARTAMENTO DE VALLE DEL CAUCA – GRUPO 02

Contrato No. PAF-JU02-G02DC-2015

INFORME CÁLCULO Y ANALISIS ESTRUCTURAL INSTITUCIÓN EDUCATIVA ALFREDO BONILLASEDE No. 2 MARIA INMACULADA (BLOQUE C)

VERSION 0

BOGOTÁ
2017

CONTROL DE REVISIONES

REVISIÓN	FECHA	OBSERVACIONES
1	30/12/16	Primera Redacción

Elaborado por:	Revisado por:	Aprobado por:
Edgar Rolando Barrera Firma:	Javier José Carrillo Ortega Fecha: Enero 2017 Firma:	Director de Interventoría Fecha: Firma:

TABLA DE CONTENIDO

LISTA DE FOTOGRAFÍAS

1 INTRODUCCIÓN

El presente documento contiene las memorias de análisis y diseño estructural correspondiente al proyecto de la "INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMAULADA" ubicado en el municipio de JAMUNDÍ en el departamento de VALLE DEL CAUCA de acuerdo al contrato No. PAF-JU02-G02DC-2015 realizando el estudio de acuerdo a la Norma Colombiana de Diseño y Construcción Sismo Resistente Ley 400 de 1997 (Modificada Ley 1229 de 2008) y Decreto 926 de Marzo de 2010, Decreto 092 del 17 de Enero de 2011, Decreto 0340 del 13 de Febrero de 2012 y en el Reglamento para Concreto Estructural ACI 318S-08.

Para la evaluación de la edificación se ha seguido un proceso normativo que incluye las etapas de inspección, evaluación, pruebas y ensayos, revisión analítica, propuesta de intervención y soluciones constructivas, que tomen en cuenta los aspectos de resistencia, ductilidad, comportamiento y estabilidad de la estructura.

2 DESCRIPCIÓN DEL TRABAJO DE OFICINA

De acuerdo a los planos arquitectónicos y visitas realizadas en campo se procedió al desarrollo del estudio y análisis estructural con la ayuda de diferentes programas tales como ETABS v9.7.4, el cual tiene en cuenta los efectos de segundo orden. Por otro lado se siguieron las recomendaciones descrita en el respectivo estudio de suelos

3 DESCRIPCIÓN DE LOS CRITERIOS BÁSICOS DE DISEÑO

El proyecto se soluciona mediante el diseño de una estructura aporticada, utilizando para el entrepiso del nivel N:-0.05 m Y N:+3.45 m placa maciza de espesor e= 0.10 m en N:+6.95 m placa maciza en dos direcciones de espesor e=0.15 m para soportar la carga del tanque. La cubierta liviana se compone de perfiles y correas en el nivel N:+6.95 m. Se manejan luces entre 5.00 m y 7.00 m en los dos sentidos de la estructura.

4 NORMAS Y CÓDIGOS A LOS CUALES SE CIÑEN LOS DISEÑOS

El diseño de todas las estructuras se realizó basado en la Norma Colombiana de Diseño y Construcción Sismo Resistente Ley 400 de 1997 (Modificada Ley 1229 de 2008) y Decreto 926 de Marzo de 2010, Decreto 092 del 17 de Enero de 2011, Decreto 0340 del 13 de Febrero de 2012 y en el Reglamento para Concreto Estructural ACI 318S-08.

5 DESCRIPCIÓN DE LA METODOLOGÍA DE DISEÑO EMPLEADA.

El proyecto se soluciona mediante el diseño de una estructura aporticada, utilizando para el entrepiso del nivel N:-0.05 m Y N:+3.45 m placa maciza de espesor e= 0.10 m en N:+6.95 m placa maciza en dos direcciones de espesor e=0.15 m para soportar la carga del tanque. La cubierta liviana se compone de perfiles y correas en el nivel N:+6.95 m. Se manejan luces entre 5.00 m y 7.00 m en los dos sentidos de la estructura.

Las cargas horizontales fueron distribuidas entre los diferentes pórticos en proporción a su rigidez y teniendo en cuenta los efectos de torsión.

El dimensionamiento dado a todos los elementos que intervienen en las estructuras satisfacen los requerimientos de solicitación ocasionados por las derivas presentes. Las cargas vivas de diseño son: **2.00 kN/ m²** para salones de clase, **5.00 kN/ m²** para tanques y corredores, y **0.35 kN/ m²** para cubiertas.

Para la cimentación se siguieron las recomendaciones descritas en el respectivo estudio de suelos, que recomienda apoyar la estructura a **-1.50 m** del nivel de la placa aérea de cimentación, apoyando las zapatas a **-1.50 m**, según lo indicado en los planos estructurales. La capacidad portante de seguridad admisible del suelo es **0.12 MPa** y el tipo de suelo es **E**.

6 DESCRIPCIÓN Y ANÁLISIS DE LAS CONDICIONES EXISTENTES

El sitio donde se procederá a la construcción de la estructura se encuentra ubicado una edificación existente, como se evidenciara en las fotos mostradas a continuación.

1Fotografía Estructura existente

Fuente: Propia

2Fotografía Estructura existente

Fuente: Propia

3 Fotografía Estructura existente

Fuente: Propia

4 Fotografía Estructura existente

Fuente: Propia

MEMORIAL DE RESPONSABILIDAD

JAMUNDÌ, Agosto de 2017.

Señores

PLANEACION MUNICIPAL
La Ciudad

Yo, **EDGAR ROLANDO BARRERA,** ingeniero civil con Matrícula Profesional Nº **15202-102710** de **BOYACÁ,** debidamente registrado en el consejo profesional de Ingeniería y Arquitectura de Boyacá, presento los cálculos y diseños estructurales elaborados de acuerdo a los requerimientos de la **NORMA COLOMBIANA DE DISEÑO Y CONSTRUCCIÓN SISMO RESISTENTE LEY 400 DE 1997 (MODIFICADA LEY 1229 DE 2008) Y DECRETO 926 DE MARZO DE 2010**, para el proyecto **JORNADA ÚNICA DEL MINISTERIO DE EDUCACIÓN- MODULO 2. INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMAULADA**, declaro que asumo la responsabilidad por los perjuicios que causa de ellos puedan deducirse, exonerando a la PLANEACION MUNICIPAL de cualquier responsabilidad.

Acepto y reconozco que la revisión efectuada por PLANEACION URBANA no constituye una aprobación al Diseño Estructural, sino una verificación del cumplimiento de la **NORMA COLOMBIANA DE DISEÑO Y CONSTRUCCIÓN SISMO RESISTENTE**.

Atentamente,

____

EDGAR ROLANDO BARRERA

ING. ESTRUCTURAL

T.P. 15202-102710 BYC


REPUBLICA DE COLOMBIA
CONSEJO PROFESIONAL NACIONAL DE INGENIERIA
Y SUS PROFESIONES AUXILIARES
INGENIERO CIVIL
BARRERA SALINAS
EDGAR ROLANDO
UNIVERSIDAD PEDAGOGICA Y
TECNOLOGICA DE COLOMBIA
PRESIDENTE DEL CONSEJO

7 MEMORIA DE CÁLCULO

7.1 AVALUO DE CARGAS

AVALUO DE CARGAS

1. CUBIERTA LIVIANA

Teja termo-acústica			0,10 kN/m²
Estructura metálica de soporte			0,10 kN/m²
Acabados e iluminacion			0,10 kN/m²
		CM	0,30 kN/m²
	Tabla 4.2.1-2 de NSR-10 (Caso F)	CV	0,35 kN/m²
		CR	0,65 kN/m²
Muros culata	0.5x0.15x13		0,98 kN/m

CU = 1.2x0.3+1.6x0.35 = ***0,9 kN/m²***

Espesor de placa equivalente:

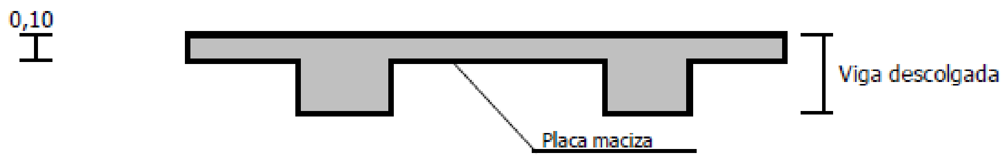
e=CM/24 0,013 m

Pendiente de Cubierta α (º) = **17,000** → Equivale a 30.6%

B.4.8.3 de NSR-10 (Carga de granizo) CV

Según la tabla B.4.2.1-2 - En cubiertas inclinadas con menos de 15º de pendiente en estructura metálica o de madera la carga viva asumida puede ser 1 kN/m^2.
Según B.4.8.3.1 - Las cargas de granizo deben tenerse en cuenta en las regiones del país con más de 2.000 metros de altura sobre el nivel del mar o en lugares de menor altura donde la autoridad municipal o distrital así lo exija.
Según B.4.8.3.2 - Para cubiertas con inclinación mayor a 15% el valor de la carga viva para granizo puede reducirse a 0.5 kN/m^2.

2. PLACA MACIZA - ENTREPISO



Placa maciza e=0.10m	0.10x24		2,40 kN/m²
Acabados	22x0.05		1,10 kN/m²
		CM	3,50 kN/m²
	Tabla 4.2.1-1	CV	2,00 kN/m²
		CR	5,50 kN/m²

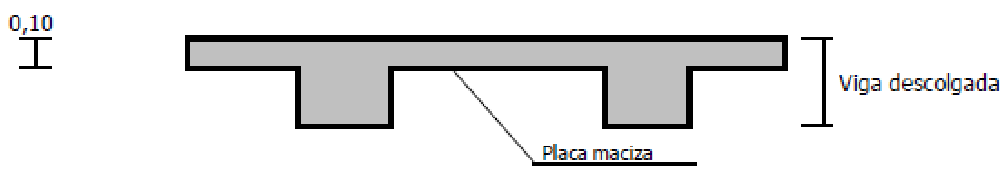
Muros antepecho	0.5x0.15x13	0,98 kN/m
Muros perimetrales	3.05x0.15x13	5,95 kN/m

CU = 1.2x3.5+1.6x2 = ***7,4 kN/m²***

Espesor de placa equivalente:

e=CM/24 0,146 m

3. PLACA MACIZA - ENTREPISO



Placa maciza e=0.10m	0.10x24		2,40 kN/m²
Acabados	22x0.05		1,10 kN/m²
		CM	3,50 kN/m²
	Tabla 4.2.1-2 (Caso A)	CV	5,00 kN/m²
		CR	8,50 kN/m²

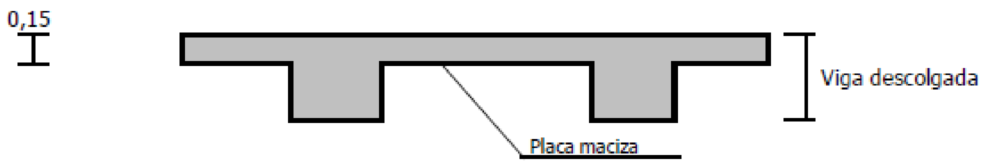
Muros antepecho	1.00x0.15x13	1,95 kN/m

CU = 1.2x3.5+1.6x5 = ***12,2 kN/m²***

Espesor de placa equivalente:

e=CM/24 0,146 m

3. PLACA MACIZA - TANQUES



Placa maciza e=0.15m	0.15x24		3,60 kN/m²
Acabados	22x0.05		1,10 kN/m²
		CM	4,70 kN/m²
	Tabla 4.2.1-2 (Caso A)	CV	5,00 kN/m²
		CR	9,70 kN/m²
Muros antepecho	1.43x0.15x13		2,79 kN/m

CU = 1.2x4.7+1.6x5 = ***13,6 kN/m²***

Espesor de placa equivalente:

e=CM/24 0,196 m

7.1.1 AVALÚO DE CARGAS DE VIENTO ANÁLISIS SIMPLIFICADO (sprfv)

Para que le análisis se pueda realizar mediante el método de diseño simplificado se requiere que se cumpla con lo establecido por la NSR-10 titulo B.6.4.1.1. y B.6.4.1.2.

a - El edificio sea de diafragma simple como se define en la sección B.6.2. b - El edificio sea bajo de acuerdo con lo establecido con la sección B.6.2.
c - El edificio sea cerrado como se define en la sección B.6.2. y cumpla las provisiones de zonas propensas a huracanes de acuerdo con la sección B.6.5.9.3.
d - El edificio sea de forma regular como se define en la sección B.6.2.
e - El edificio no sea clasificado como flexible como se define en la sección B.6.2.
f - Las características de respuesta del edificio sean tales que el mismo no esté sujeto a las cargas por viento a travéz de él, a generación de vórtices, a inestabilidad por golpeteo o aleteo, y no esté ubicado en un sitio en el que se puedan presentar efectos de canalización
o sacudimiento por la estela de obstrucciones en barlovento, que obliguen a concideraciones especiales.
g - El edificio tenga una sección transversal aproximadamente simétrica en cada dirección y tenga una cubierta plana o cubierta a dos o cuatro aguas con ángulo de inclinación ∅ ≤ ϰϱ°
h - El edificio esta eximido de los casos de carga torsional indicados en la nota 5 de la figura B.6.5.7. o estos casos no conctrolan el diseño de ninguno de los elementos del SPRFV del edificio.

De los anteriores parametros se observa que la edificación cumple con lo estipulado, por lo

tanto: Tipo de análisis permitido: ANÁLISIS SIMPLIFICADO

Entonces:

$$Ps = \lambda KztIPs_{10}$$

Donde:

λ= Factor de ajuste por altura y exposición, figura B.6.4.2.
K_{zt}= Factor topográfico como se define en la sección B.6.5.7. evaluado a la altura promedio de la cubierta,
h, B.6.5.1. I= Factor de importancia como se define en la sección B.6.5.5.
P_{s10}= Presión de viento de diseño simplificado para la categoria de exposición B, con h=10 m de la figura B.6.4.2.

	CIUDAD	ZONA	VELOCIDAD DEL VIENTO
Zona de amenza eólica=	JAMUNDÍ	3	100 Km/h

Luego:

λ= 1,0
K_{zt}= 1,0
I= 1,0
P_{s10}= 0,13

Según B.6.4.2.1.1. Presiones mínimas: Los efectos de carga de las presiones de viento de diseño de la sección B.6.4.2.1. no serán menores que el caso de carga mínima de la sección B.6.1.3.1. suponiendo presiones Ps, de +0.40 kN/m^2 para las zonas de A, B, C y D y de
0.00 kN/m^2 paras las zonas E, F, G y H.

Por lo tanto la carga de viento a emplear es: 0,40 kN/m^2

7.2 ANALISIS SISMICO

7.2.1 ANÁLISIS SÍSMICO (ESPECTRO DE DISEÑO NSR-10)

ANÁLISIS SÍSMICO (ESPECTRO DE DISEÑO NSR-10)

ZONA DE AMENAZA SÍSMICA
ALTA

EFECTOS LOCALES

Perfil de Suelo	E
Coeficiente Aa	0,25
Coeficiente Av	0,25

COEFICIENTE DE IMPORTANCIA

Grupo de Uso	III
Coeficiente de importancia I	1,25

PERIODO FUNDAMENTAL DE LA EDIFICACIÓN

$T_a = C_t h^{\alpha}$		
C_t =	0,047	
h =	7,00	m
α =	0,90	
T_a=	0,27	Seg

VARIACIÓN COEFICIENTE DE CAPACIDAD DE DISIPACIÓN DE ENERGÍA

Ro: Coeficiente de capacidad de disipación de energía básico

R: Coeficiente de capacidad de disipación de energía, para ser empleado en el diseño.

ϕ_a: Coeficiente de reducción de R causado por irregularidades en altura de la edificación

ϕ_p: Coeficiente de reducción de R causado por irregularidades en planta de la edificación

ϕ_r: Coeficiente de reducción de R causado por ausencia de redundancia en el sistema estructural de resistencia sísmica

Ro	7,00
ϕ_a	1,00
ϕ_p	1,00
ϕ_r	1,00
ϕ	1,00
R	7,00

TIPO	DESCRIPCIÓN	VALOR
	N.A	ϕ_p: 1.00
	N.A	ϕ_a: 1.00
	AUSENCIOA DE REDUNDANCIA	ϕ_r: 1.00
	UNIONES SOLDADAS	ϕ: 1.00

ESPECTRO DE DISEÑO (AMORTIGUAMIENTO ξ=5% DEL CRÍTICO)

Fa: Factor de ampliación de la aceleración.
Fv: Factor de ampliación de la aceleración en el rango de velocidades constantes.
Sa: Valor del espectro de aceleraciones de diseño para un periodo de vibración dado.
Aa: Coeficiente que representa la aceleración horizontal pico efectiva para diseño.
Av: Coeficiente que representa la velocidad horizontal pico efectiva para diseño.
T: Periodo de vibración del sistema elástico, en segundos.
T_C: Periodo de vibración, en segundos, correspondiente a la transición entre la zona de aceleración constante del espectro de diseño, para periodos cortos, y la parte descendiente del mismo.
T_L: Periodo de vibración, en segundos, correspondiente al inicio de la zona de desplazamiento aproximadamente constante del espectro de diseño para periodos largos.

ZONA DE AMENAZA ALTA

T_o:	0,21	Seg
T_C:	0,99	Seg
T_L:	7,20	Seg
Aa:	0,25	
Av:	0,25	
Fa:	1,45	
Fv:	3,00	

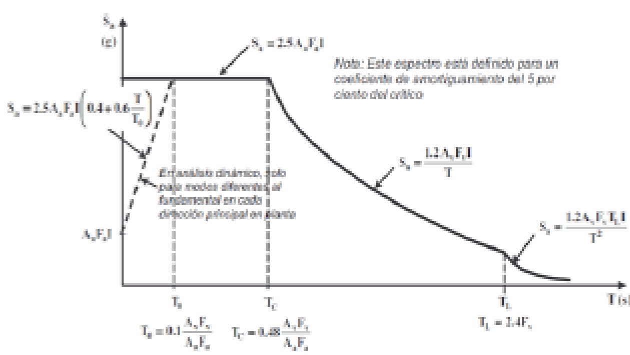
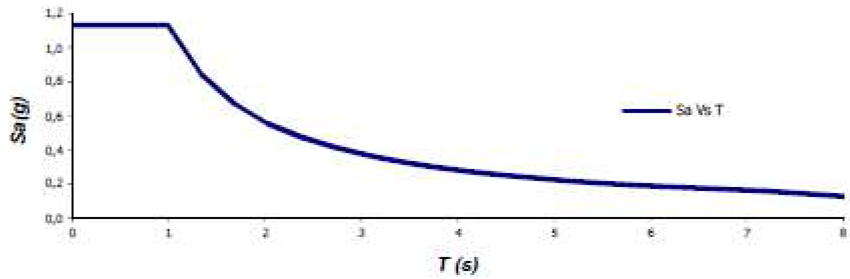


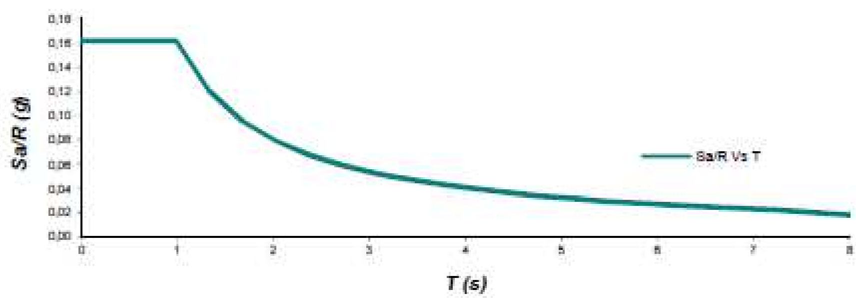
Figura A.2.6-1 — Espectro Elástico de Aceleraciones de Diseño como fracción de g

T	Sa	Sa/$R_{adoptado}$
(Seg)	(%g)	(%g)
0,00	1,133	0,162
0,05	1,133	0,162
0,10	1,133	0,162
0,16	1,133	0,162
0,21	1,133	0,162
0,40	1,133	0,162
0,60	1,133	0,162
0,80	1,133	0,162
0,99	1,133	0,162
1,34	0,841	0,120
1,68	0,669	0,096
2,03	0,555	0,079
2,37	0,474	0,068
2,72	0,414	0,059
3,06	0,367	0,052
3,41	0,330	0,047
3,75	0,300	0,043
4,10	0,275	0,039
4,44	0,253	0,036
4,79	0,235	0,034
5,13	0,219	0,031
5,48	0,205	0,029
5,82	0,193	0,028
6,17	0,182	0,026
6,51	0,173	0,025
6,86	0,164	0,023
7,20	0,156	0,022
8,20	0,120	0,017
9,20	0,096	0,014

Espectro Elástico de Diseño



Espectro Elástico de Diseño/R_{adop}



Sistema de resistencia Sísmica: Pórticos resistentes a momentos con Capacidad Especial de Disipación de Energía (DES).

Nota: El sistema de pórtico es un sistema estructural compuesto por un pórtico espacial, resistente a momentos, esencialmente completo, sin diagonales, que resiste todas las cargas verticales y las fuerzas horizontales.

MODELO MATEMÁTICO

Modelo Tridimensional con Diafragma Rígido: En este modelo los entrepisos se consideran diafragmas infinitamente rigidos en su propio plano. La masa de cada diafragma se considera concentrada en su centro de masa. Los efectos torsionales accidentales son incluidos haciendo ajustes en la localización de los centros de masa de los diafragmas.
Los efectos direccionales son tomados en cuenta a través de las componentes de los desplazamientos de los grados de libertad horizontales ortogonales del diafragma.

7.2.2 ANÁLISIS SÍSMICO (ESPECTRO DE UMBRAL DE DAÑO NSR-10)

ANÁLISIS SÍSMICO (ESPECTRO DE UMBRAL DE DAÑO NSR-10)

ZONA DE AMENAZA SÍSMICA
ALTA

EFECTOS LOCALES

Perfil de Suelo	E
Coeficiente Ad	0,09
Coeficiente Fv	3,50

COEFICIENTE DE IMPORTANCIA

Grupo de Uso	III
Coeficiente de importancia I	1,25
Coeficiente de Sitio Š:	4,38

ESPECTRO DE UMBRAL DE DAÑO (AMORTIGUAMIENTO ξ=2% DEL CRÍTICO)

Sad: Valor del espectro de aceleraciones del umbral de daño para un periodo de vibración dado.
Ad: Máxima aceleración pico efectiva para el umbral de daño.
T: Periodo de vibración del sistema elástico, en segundos.
T_{Cd}: Periodo de vibración, en segundos, correspondiente a la transición entre la zona de aceleración constante del espectro sísmico del umbral de daño, para periodos cortos, y la parte descendiente del mismo.
T_{Ld}: Periodo de vibración, en segundos, correspondiente a la transición entre la zona de desplazamiento constante del espectro sísmico del umbral de daño, para periodos largos.

Ad:	**0,09**
T_{Cd}:	2,19 Seg
T_{Ld}:	10,5 Seg

T (Seg)	Sad (%g)
0,00	0,090
0,05	0,126
0,10	0,162
0,15	0,198
0,20	0,234
0,25	0,270
0,49	0,270
0,73	0,270
0,98	0,270
1,22	0,270
1,46	0,270
1,70	0,270
1,95	0,270

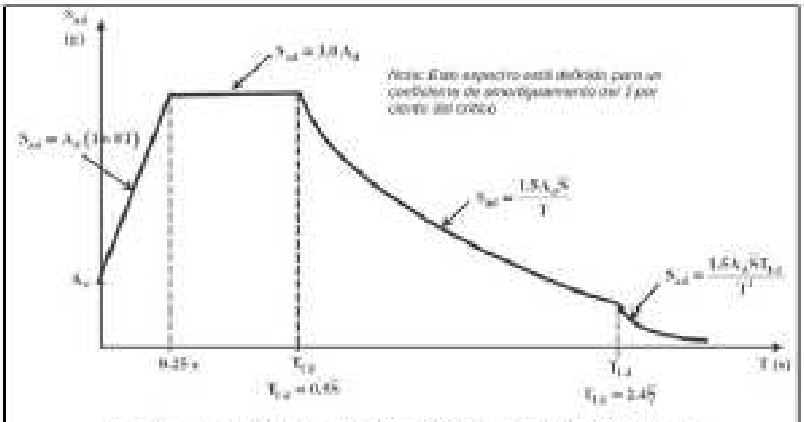
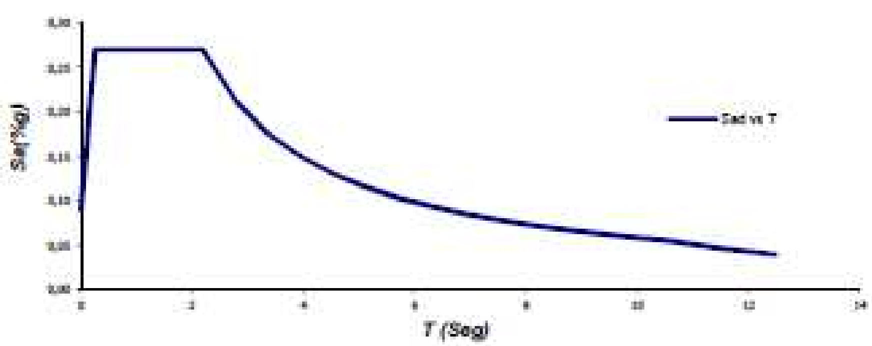


Figura A.12.3-1 — Espectro de aceleraciones horizontales elástico del umbral de daño

2,19	0,270
2,78	0,212
3,38	0,175
3,97	0,149
4,56	0,129
5,16	0,115
5,75	0,103
6,34	0,093
6,94	0,085
7,53	0,078
8,13	0,073
8,72	0,068
9,31	0,063
9,91	0,060
10,50	0,056
11,50	0,047
12,50	0,040

Espectro Del Umbral de Daño



Sistema de resistencia Sísmica: Pórticos resistentes a momentos con Capacidad Especial de Disipación de Energía (DES).

Nota: El sistema de pórtico es un sistema estructural compuesto por un pórtico espacial, resistente a momentos, esencialmente completo, sin diagonales, que resiste todas las cargas verticales y las fuerzas horizontales.

MODELO MATEMÁTICO

Modelo Tridimensional con Diafragma Rígido: En este modelo los entrepisos se consideran diafragmas infinitamente rígidos en su propio plano. La masa de cada diafragma se considera concentrada en su centro de masa. Los efectos torsionales accidentales son incluidos haciendo ajustes en la localización de los centros de masa de los diafragmas.
Los efectos direccionales son tomados en cuenta a través de las componentes de los desplazamientos de los grados de libertad horizontales ortogonales del diafragma.

7.2.3 CALCULO DEL CORTANTE BASAL DE LA ESTRUCTURA (ESPECTRO DE DISEÑO NSR-10)

CALCULO DEL CORTANTE BASAL DE LA ESTRUCTURA

$H_{edificio}$ =	7,00	m	
Tipo de Perfil:	E		
Aa =	0,25		
Av =	0,25		
Fa =	1,45		
Fv =	3,00		
T_C =	0,99	Seg	
C_t =	0,047		
α =	0,90		
T_a =	0,27	Seg	
C_u =	1,20		
$C_u T_a$ =	0,32	Seg	
$T_{modelación\ estructural}$ =	0,28	Seg	
ΔT =	3,39	%	Ok!
$T_{adoptado}$ =	0,28	Seg	
S_a =	1,133		S_a obtenido del espectro de diseño
g =	9,81	m/s^2	
M =	301,58	Ton	Masa obtenida del modelo
V_s =	3352,01	kN	
90% Vs =	3016,81	kN	Cortante basal para comparación de acuerdo a A.5.4.5 NSR-1(

MODELO INICIAL

Response Espectrum Base Reactions

PORCENTAJE PARA REVISIÓN DE CORTANTE BASAL DE ACUERDO A A.5.4.5 NSR-10: 90,0 %

	F1	F2	Total	Factor		g corregido
$V_{s(x)}$=	2903,26	0	2903,26	1,039	10,194	Se aplica en
$V_{s(y)}$=	0	2536,17	2536,17	1,190	11,669	Se aplica en

MODELO CORREGIDO

Response Espectrum Base Reactions

	F1	F2	Total	90% Vs
$V_{s(x)}$=	3016,9	0	3016,90	3016,8
$V_{s(y)}$=	0	3016,78	3016,78	3016,8

7.2.4 CALCULO DEL CORTANTE BASAL DE LA ESTRUCTURA (ESPECTRO DE UMBRAL DE DAÑO NSR-10)

CALCULO DEL CORTANTE BASAL DE LA ESTRUCTURA

$H_{edificio}$ =	7,00	m	
Tipo de Perfil:	E		
Ad =	0,09		
Fv =	0,40		
C_t =	0,047		
α =	0,90		
T_a =	0,27	Seg	
C_u =	1,20		
$C_u T_a$ =	0,32	Seg	
$T_{modelación\ estructural}$ =	0,28	Seg	
ΔT =	3,39	%	Ok!
$T_{adoptado}$ =	0,27	Seg	
S_a =	0,270		S_a obtenido del espectro de diseño
g =	9,81	m/s^2	
M =	301,58	Ton	Masa obtenida del modelo
V_s =	798,80	kN	

MODELO INICIAL
Response Espectrum Base Reactions

PORCENTAJE PARA REVISIÓN DE CORTANTE BASAL DE ACUERDO A A.5.4.5 NSR-10: 100,0 %

	F1	F2	Total	Factor		g corregido
$V_{s(x)}$=	688,59	0	688,59	1,160	11,380	Se aplica en
$V_{s(y)}$=	0	595,52	595,52	1,341	13,159	Se aplica en

MODELO CORREGIDO
Response Espectrum Base Reactions

	F1	F2	Total	100% Vs
$V_{s(x)}$=	798,79	0	798,79	798,8
$V_{s(y)}$=	0	798,82	798,82	798,8

7.2.5 CÁLCULO DE DERIVAS MÁXIMAS

CÁLCULO DE DERIVAS MÁXIMAS

ALTURA DE N+8.29	0,50	m
ALTURA DE N+8.80	1,50	m
ALTURA DE N+7.40	0,65	m
ALTURA DE N+6.95	3,50	m
ALTURA DE N+3.45	3,50	m
ALTURA DE BASE	0,00	m

Deriva Máxima Permitida	1,00	%

Nivel	Punto	COMBINACIÓN DE CARGA	DESPLAZAMIENTOS FUERZA SÍSMICA Desplazamiento X	Desplazamiento Y	Deriva Δ m	Deriva Δ %	Observación
N+6.95	1	COMDER1 MAX	0,03269	0,0266	0,02340	0,67	OK
N+6.95	1	COMDER1 MIN	-0,03269	-0,0266	0,02340	0,67	OK
N+6.95	1	COMDER2 MAX	0,02177	0,03248	0,02213	0,63	OK
N+6.95	1	COMDER2 MIN	-0,02177	-0,03248	0,02213	0,63	OK
N+3.45	1	COMDER1 MAX	0,01477	0,01155	0,01875	0,54	OK
N+3.45	1	COMDER1 MIN	-0,01477	-0,01155	0,01875	0,54	OK
N+3.45	1	COMDER2 MAX	0,00959	0,014	0,01697	0,48	OK
N+3.45	1	COMDER2 MIN	-0,00959	-0,014	0,01697	0,48	OK
BASE	1	COMDER1 MAX	0	0	--	--	--
BASE	1	COMDER1 MIN	0	0	--	--	--
BASE	1	COMDER2 MAX	0	0	--	--	--
BASE	1	COMDER2 MIN	0	0	--	--	--
N+6.95	26	COMDER1 MAX	0,02828	0,0266	0,02163	0,62	OK
N+6.95	26	COMDER1 MIN	-0,02828	-0,0266	0,02163	0,62	OK
N+6.95	26	COMDER2 MAX	0,01813	0,03248	0,02108	0,60	OK
N+6.95	26	COMDER2 MIN	-0,01813	-0,03248	0,02108	0,60	OK
N+3.45	26	COMDER1 MAX	0,01274	0,01155	0,01720	0,49	OK
N+3.45	26	COMDER1 MIN	-0,01274	-0,01155	0,01720	0,49	OK
N+3.45	26	COMDER2 MAX	0,00798	0,014	0,01611	0,46	OK
N+3.45	26	COMDER2 MIN	-0,00798	-0,014	0,01611	0,46	OK
BASE	26	COMDER1 MAX	0	0	--	--	--
BASE	26	COMDER1 MIN	0	0	--	--	--
BASE	26	COMDER2 MAX	0	0	--	--	--
BASE	26	COMDER2 MIN	0	0	--	--	--
N+6.95	27	COMDER1 MAX	0,02828	0,02093	0,01962	0,56	OK
N+6.95	27	COMDER1 MIN	-0,02828	-0,02093	0,01962	0,56	OK
N+6.95	27	COMDER2 MAX	0,01813	0,03038	0,02035	0,58	OK
N+6.95	27	COMDER2 MIN	-0,01813	-0,03038	0,02035	0,58	OK
N+3.45	27	COMDER1 MAX	0,01274	0,00896	0,01558	0,45	OK
N+3.45	27	COMDER1 MIN	-0,01274	-0,00896	0,01558	0,45	OK
N+3.45	27	COMDER2 MAX	0,00798	0,01274	0,01503	0,43	OK
N+3.45	27	COMDER2 MIN	-0,00798	-0,01274	0,01503	0,43	OK
BASE	27	COMDER1 MAX	0	0	--	--	--
BASE	27	COMDER1 MIN	0	0	--	--	--
BASE	27	COMDER2 MAX	0	0	--	--	--
BASE	27	COMDER2 MIN	0	0	--	--	--
N+6.95	28	COMDER1 MAX	0,02828	0,01764	0,01872	0,53	OK
N+6.95	28	COMDER1 MIN	-0,02828	-0,01764	0,01872	0,53	OK
N+6.95	28	COMDER2 MAX	0,01813	0,0336	0,02251	0,64	OK
N+6.95	28	COMDER2 MIN	-0,01813	-0,0336	0,02251	0,64	OK
N+3.45	28	COMDER1 MAX	0,01274	0,00721	0,01464	0,42	OK
N+3.45	28	COMDER1 MIN	-0,01274	-0,00721	0,01464	0,42	OK
N+3.45	28	COMDER2 MAX	0,00798	0,01351	0,01569	0,45	OK
N+3.45	28	COMDER2 MIN	-0,00798	-0,01351	0,01569	0,45	OK
BASE	28	COMDER1 MAX	0	0	--	--	--
BASE	28	COMDER1 MIN	0	0	--	--	--
BASE	28	COMDER2 MAX	0	0	--	--	--
BASE	28	COMDER2 MIN	0	0	--	--	--
N+6.95	29	COMDER1 MAX	0,02828	0,0203	0,01979	0,57	OK
N+6.95	29	COMDER1 MIN	-0,02828	-0,0203	0,01979	0,57	OK
N+6.95	29	COMDER2 MAX	0,01813	0,04494	0,02899	0,83	OK
N+6.95	29	COMDER2 MIN	-0,01813	-0,04494	0,02899	0,83	OK
N+3.45	29	COMDER1 MAX	0,01274	0,00805	0,01507	0,43	OK
N+3.45	29	COMDER1 MIN	-0,01274	-0,00805	0,01507	0,43	OK
N+3.45	29	COMDER2 MAX	0,00798	0,01778	0,01949	0,56	OK
N+3.45	29	COMDER2 MIN	-0,00798	-0,01778	0,01949	0,56	OK
BASE	29	COMDER1 MAX	0	0	--	--	--
BASE	29	COMDER1 MIN	0	0	--	--	--
BASE	29	COMDER2 MAX	0	0	--	--	--
BASE	29	COMDER2 MIN	0	0	--	--	--
N+6.95	30	COMDER1 MAX	0,02828	0,0245	0,02149	0,61	OK
N+6.95	30	COMDER1 MIN	-0,02828	-0,0245	0,02149	0,61	OK
N+6.95	30	COMDER2 MAX	0,01813	0,05397	0,03423	0,98	OK
N+6.95	30	COMDER2 MIN	-0,01813	-0,05397	0,03423	0,98	OK
N+3.45	30	COMDER1 MAX	0,01274	0,00966	0,01599	0,46	OK
N+3.45	30	COMDER1 MIN	-0,01274	-0,00966	0,01599	0,46	OK
N+3.45	30	COMDER2 MAX	0,00798	0,02128	0,02273	0,65	OK
N+3.45	30	COMDER2 MIN	-0,00798	-0,02128	0,02273	0,65	OK
BASE	30	COMDER1 MAX	0	0	--	--	--
BASE	30	COMDER1 MIN	0	0	--	--	--
BASE	30	COMDER2 MAX	0	0	--	--	--
BASE	30	COMDER2 MIN	0	0	--	--	--
N+6.95	31	COMDER1 MAX	0,03269	0,02093	0,02155	0,62	OK
N+6.95	31	COMDER1 MIN	-0,03269	-0,02093	0,02155	0,62	OK
N+6.95	31	COMDER2 MAX	0,02177	0,03038	0,02144	0,61	OK
N+6.95	31	COMDER2 MIN	-0,02177	-0,03038	0,02144	0,61	OK
N+3.45	31	COMDER1 MAX	0,01477	0,00896	0,01728	0,49	OK
N+3.45	31	COMDER1 MIN	-0,01477	-0,00896	0,01728	0,49	OK
N+3.45	31	COMDER2 MAX	0,00959	0,01274	0,01595	0,46	OK
N+3.45	31	COMDER2 MIN	-0,00959	-0,01274	0,01595	0,46	OK

CÁLCULO DE DERIVAS MÁXIMAS

ALTURA DE N+[illegible]	0,50	m
ALTURA DE N+[illegible]	1,50	m
ALTURA DE N+[illegible]	0,65	m
ALTURA DE N+6.95	3,50	m
ALTURA DE N+3.45	3,50	m
ALTURA DE BASE	0,00	m

Deriva Máxima Permitida	1,00	%

Nivel	Punto	COMBINACIÓN DE CARGA	DESPLAZAMIENTOS FUERZA SÍSMICA		Deriva Δ	Deriva Δ	Observación
			Desplazamiento X	Desplazamiento Y	m	%	
BASE	31	COMDER1 MAX	0	0	---	---	---
BASE	31	COMDER1 MIN	0	0	---	---	---
BASE	31	COMDER2 MAX	0	0	---	---	---
BASE	31	COMDER2 MIN	0	0	---	---	---
N+6.95	32	COMDER1 MAX	0,03269	0,01764	0,02073	0,59	OK
N+6.95	32	COMDER1 MIN	-0,03269	-0,01764	0,02073	0,59	OK
N+6.95	32	COMDER2 MAX	0,02177	0,0336	0,02349	0,67	OK
N+6.95	32	COMDER2 MIN	-0,02177	-0,0336	0,02349	0,67	OK
N+3.45	32	COMDER1 MAX	0,01477	0,00721	0,01644	0,47	OK
N+3.45	32	COMDER1 MIN	-0,01477	-0,00721	0,01644	0,47	OK
N+3.45	32	COMDER2 MAX	0,00959	0,01351	0,01657	0,47	OK
N+3.45	32	COMDER2 MIN	-0,00959	-0,01351	0,01657	0,47	OK
BASE	32	COMDER1 MAX	0	0	---	---	---
BASE	32	COMDER1 MIN	0	0	---	---	---
BASE	32	COMDER2 MAX	0	0	---	---	---
BASE	32	COMDER2 MIN	0	0	---	---	---
N+6.95	33	COMDER1 MAX	0,03269	0,0203	0,02171	0,62	OK
N+6.95	33	COMDER1 MIN	-0,03269	-0,0203	0,02171	0,62	OK
N+6.95	33	COMDER2 MAX	0,02177	0,04494	0,02977	0,85	OK
N+6.95	33	COMDER2 MIN	-0,02177	-0,04494	0,02977	0,85	OK
N+3.45	33	COMDER1 MAX	0,01477	0,00805	0,01682	0,48	OK
N+3.45	33	COMDER1 MIN	-0,01477	-0,00805	0,01682	0,48	OK
N+3.45	33	COMDER2 MAX	0,00959	0,01778	0,02020	0,58	OK
N+3.45	33	COMDER2 MIN	-0,00959	-0,01778	0,02020	0,58	OK
BASE	33	COMDER1 MAX	0	0	---	---	---
BASE	33	COMDER1 MIN	0	0	---	---	---
BASE	33	COMDER2 MAX	0	0	---	---	---
BASE	33	COMDER2 MIN	0	0	---	---	---
N+6.95	34	COMDER1 MAX	0,03269	0,0245	0,02327	0,66	OK
N+6.95	34	COMDER1 MIN	-0,03269	-0,0245	0,02327	0,66	OK
N+6.95	34	COMDER2 MAX	0,02177	0,05397	0,03489	1,00	OK
N+6.95	34	COMDER2 MIN	-0,02177	-0,05397	0,03489	1,00	OK
N+3.45	34	COMDER1 MAX	0,01477	0,00966	0,01765	0,50	OK
N+3.45	34	COMDER1 MIN	-0,01477	-0,00966	0,01765	0,50	OK
N+3.45	34	COMDER2 MAX	0,00959	0,02128	0,02334	0,67	OK
N+3.45	34	COMDER2 MIN	-0,00959	-0,02128	0,02334	0,67	OK
BASE	34	COMDER1 MAX	0	0	---	---	---
BASE	34	COMDER1 MIN	0	0	---	---	---
BASE	34	COMDER2 MAX	0	0	---	---	---
BASE	34	COMDER2 MIN	0	0	---	---	---

CÁLCULO DE DERIVAS MÁXIMAS (ESPECTRO DE UMBRAL DE DAÑO)

ALTURA DE N+[illegible]	0,50	m		Deriva Máxima Permitida	0,40	%
ALTURA DE N+[illegible]	1,50	m				
ALTURA DE N+7.45	0,65	m				
ALTURA DE N+6.95	3,50	m				
ALTURA DE N+3.45	3,50	m				
ALTURA DE BASE	0,00	m				

Nivel	Punto	COMBINACIÓN DE CARGA	DESPLAZAMIENTOS FUERZA SÍSMICA		Deriva Δ m	Deriva Δ %	Observación
			Desplazamiento X	Desplazamiento Y			
N+6.95	1	COMDERUMB1 MAX	0,0122	0,0094	0,00854	0,24	OK
N+6.95	1	COMDERUMB1 MIN	-0,0122	-0,0094	0,00854	0,24	OK
N+6.95	1	COMDERUMB2 MAX	0,008	0,0113	0,00791	0,23	OK
N+6.95	1	COMDERUMB2 MIN	-0,008	-0,0113	0,00791	0,23	OK
N+3.45	1	COMDERUMB1 MAX	0,0055	0,0041	0,00686	0,20	OK
N+3.45	1	COMDERUMB1 MIN	-0,0055	-0,0041	0,00686	0,20	OK
N+3.45	1	COMDERUMB2 MAX	0,0035	0,0048	0,00594	0,17	OK
N+3.45	1	COMDERUMB2 MIN	-0,0035	-0,0048	0,00594	0,17	OK
BASE	1	COMDERUMB1 MAX	0	0	--	--	--
BASE	1	COMDERUMB1 MIN	0	0	--	--	--
BASE	1	COMDERUMB2 MAX	0	0	--	--	--
BASE	1	COMDERUMB2 MIN	0	0	--	--	--
N+6.95	26	COMDERUMB1 MAX	0,0106	0,0094	0,00786	0,22	OK
N+6.95	26	COMDERUMB1 MIN	-0,0106	-0,0094	0,00786	0,22	OK
N+6.95	26	COMDERUMB2 MAX	0,0066	0,0113	0,00748	0,21	OK
N+6.95	26	COMDERUMB2 MIN	-0,0066	-0,0113	0,00748	0,21	OK
N+3.45	26	COMDERUMB1 MAX	0,0048	0,0041	0,00631	0,18	OK
N+3.45	26	COMDERUMB1 MIN	-0,0048	-0,0041	0,00631	0,18	OK
N+3.45	26	COMDERUMB2 MAX	0,0029	0,0048	0,00561	0,16	OK
N+3.45	26	COMDERUMB2 MIN	-0,0029	-0,0048	0,00561	0,16	OK
BASE	26	COMDERUMB1 MAX	0	0	--	--	--
BASE	26	COMDERUMB1 MIN	0	0	--	--	--
BASE	26	COMDERUMB2 MAX	0	0	--	--	--
BASE	26	COMDERUMB2 MIN	0	0	--	--	--
N+6.95	27	COMDERUMB1 MAX	0,0106	0,0076	0,00722	0,21	OK
N+6.95	27	COMDERUMB1 MIN	-0,0106	-0,0076	0,00722	0,21	OK
N+6.95	27	COMDERUMB2 MAX	0,0066	0,0111	0,00748	0,21	OK
N+6.95	27	COMDERUMB2 MIN	-0,0066	-0,0111	0,00748	0,21	OK
N+3.45	27	COMDERUMB1 MAX	0,0048	0,0033	0,00582	0,17	OK
N+3.45	27	COMDERUMB1 MIN	-0,0048	-0,0033	0,00582	0,17	OK
N+3.45	27	COMDERUMB2 MAX	0,0029	0,0046	0,00544	0,16	OK
N+3.45	27	COMDERUMB2 MIN	-0,0029	-0,0046	0,00544	0,16	OK
BASE	27	COMDERUMB1 MAX	0	0	--	--	--
BASE	27	COMDERUMB1 MIN	0	0	--	--	--
BASE	27	COMDERUMB2 MAX	0	0	--	--	--
BASE	27	COMDERUMB2 MIN	0	0	--	--	--
N+6.95	28	COMDERUMB1 MAX	0,0106	0,0067	0,00699	0,20	OK
N+6.95	28	COMDERUMB1 MIN	-0,0106	-0,0067	0,00699	0,20	OK
N+6.95	28	COMDERUMB2 MAX	0,0066	0,0129	0,00854	0,24	OK
N+6.95	28	COMDERUMB2 MIN	-0,0066	-0,0129	0,00854	0,24	OK
N+3.45	28	COMDERUMB1 MAX	0,0048	0,0028	0,00556	0,16	OK
N+3.45	28	COMDERUMB1 MIN	-0,0048	-0,0028	0,00556	0,16	OK
N+3.45	28	COMDERUMB2 MAX	0,0029	0,0052	0,00595	0,17	OK
N+3.45	28	COMDERUMB2 MIN	-0,0029	-0,0052	0,00595	0,17	OK
BASE	28	COMDERUMB1 MAX	0	0	--	--	--
BASE	28	COMDERUMB1 MIN	0	0	--	--	--
BASE	28	COMDERUMB2 MAX	0	0	--	--	--
BASE	28	COMDERUMB2 MIN	0	0	--	--	--
N+6.95	29	COMDERUMB1 MAX	0,0106	0,0074	0,00734	0,21	OK
N+6.95	29	COMDERUMB1 MIN	-0,0106	-0,0074	0,00734	0,21	OK
N+6.95	29	COMDERUMB2 MAX	0,0066	0,0167	0,01076	0,31	OK
N+6.95	29	COMDERUMB2 MIN	-0,0066	-0,0167	0,01076	0,31	OK
N+3.45	29	COMDERUMB1 MAX	0,0048	0,0029	0,00561	0,16	OK
N+3.45	29	COMDERUMB1 MIN	-0,0048	-0,0029	0,00561	0,16	OK
N+3.45	29	COMDERUMB2 MAX	0,0029	0,0066	0,00721	0,21	OK
N+3.45	29	COMDERUMB2 MIN	-0,0029	-0,0066	0,00721	0,21	OK
BASE	29	COMDERUMB1 MAX	0	0	--	--	--
BASE	29	COMDERUMB1 MIN	0	0	--	--	--
BASE	29	COMDERUMB2 MAX	0	0	--	--	--
BASE	29	COMDERUMB2 MIN	0	0	--	--	--
N+6.95	30	COMDERUMB1 MAX	0,0106	0,0088	0,00792	0,23	OK
N+6.95	30	COMDERUMB1 MIN	-0,0106	-0,0088	0,00792	0,23	OK
N+6.95	30	COMDERUMB2 MAX	0,0066	0,0197	0,01256	0,36	OK
N+6.95	30	COMDERUMB2 MIN	-0,0066	-0,0197	0,01256	0,36	OK
N+3.45	30	COMDERUMB1 MAX	0,0048	0,0034	0,00588	0,17	OK
N+3.45	30	COMDERUMB1 MIN	-0,0048	-0,0034	0,00588	0,17	OK
N+3.45	30	COMDERUMB2 MAX	0,0029	0,0077	0,00823	0,24	OK
N+3.45	30	COMDERUMB2 MIN	-0,0029	-0,0077	0,00823	0,24	OK
BASE	30	COMDERUMB1 MAX	0	0	--	--	--
BASE	30	COMDERUMB1 MIN	0	0	--	--	--
BASE	30	COMDERUMB2 MAX	0	0	--	--	--
BASE	30	COMDERUMB2 MIN	0	0	--	--	--
N+6.95	31	COMDERUMB1 MAX	0,0122	0,0076	0,00796	0,23	OK
N+6.95	31	COMDERUMB1 MIN	-0,0122	-0,0076	0,00796	0,23	OK
N+6.95	31	COMDERUMB2 MAX	0,008	0,0111	0,00791	0,23	OK
N+6.95	31	COMDERUMB2 MIN	-0,008	-0,0111	0,00791	0,23	OK
N+3.45	31	COMDERUMB1 MAX	0,0055	0,0033	0,00641	0,18	OK
N+3.45	31	COMDERUMB1 MIN	-0,0055	-0,0033	0,00641	0,18	OK
N+3.45	31	COMDERUMB2 MAX	0,0035	0,0046	0,00578	0,17	OK
N+3.45	31	COMDERUMB2 MIN	-0,0035	-0,0046	0,00578	0,17	OK
BASE	31	COMDERUMB1 MAX	0	0	--	--	--

CÁLCULO DE DERIVAS MÁXIMAS (ESPECTRO DE UMBRAL DE DAÑO)

ALTURA DE N+6.29	0,50	m
ALTURA DE N+8.85	1,50	m
ALTURA DE N+7.45	0,65	m
ALTURA DE N+6.95	3,50	m
ALTURA DE N+3.45	3,50	m
ALTURA DE BASE	0,00	m

Deriva Máxima Permitida	0,40	%

Nivel	Punto	COMBINACIÓN DE CARGA	DESPLAZAMIENTOS FUERZA SÍSMICA		Deriva Δ m	Deriva Δ %	Observación
			Desplazamiento X	Desplazamiento Y			
BASE	31	COMDERUMB1 MIN	0	0	—	—	—
BASE	31	COMDERUMB2 MAX	0	0	—	—	—
BASE	31	COMDERUMB2 MIN	0	0	—	—	—
N+6.95	32	COMDERUMB1 MAX	0,0122	0,0067	0,00775	0,22	OK
N+6.95	32	COMDERUMB1 MIN	-0,0122	-0,0067	0,00775	0,22	OK
N+6.95	32	COMDERUMB2 MAX	0,008	0,0129	0,00892	0,25	OK
N+6.95	32	COMDERUMB2 MIN	-0,008	-0,0129	0,00892	0,25	OK
N+3.45	32	COMDERUMB1 MAX	0,0055	0,0028	0,00617	0,18	OK
N+3.45	32	COMDERUMB1 MIN	-0,0055	-0,0028	0,00617	0,18	OK
N+3.45	32	COMDERUMB2 MAX	0,0035	0,0052	0,00627	0,18	OK
N+3.45	32	COMDERUMB2 MIN	-0,0035	-0,0052	0,00627	0,18	OK
BASE	32	COMDERUMB1 MAX	0	0	—	—	—
BASE	32	COMDERUMB1 MIN	0	0	—	—	—
BASE	32	COMDERUMB2 MAX	0	0	—	—	—
BASE	32	COMDERUMB2 MIN	0	0	—	—	—
N+6.95	33	COMDERUMB1 MAX	0,0122	0,0074	0,00807	0,23	OK
N+6.95	33	COMDERUMB1 MIN	-0,0122	-0,0074	0,00807	0,23	OK
N+6.95	33	COMDERUMB2 MAX	0,008	0,0167	0,01106	0,32	OK
N+6.95	33	COMDERUMB2 MIN	-0,008	-0,0167	0,01106	0,32	OK
N+3.45	33	COMDERUMB1 MAX	0,0055	0,0029	0,00622	0,18	OK
N+3.45	33	COMDERUMB1 MIN	-0,0055	-0,0029	0,00622	0,18	OK
N+3.45	33	COMDERUMB2 MAX	0,0035	0,0066	0,00747	0,21	OK
N+3.45	33	COMDERUMB2 MIN	-0,0035	-0,0066	0,00747	0,21	OK
BASE	33	COMDERUMB1 MAX	0	0	—	—	—
BASE	33	COMDERUMB1 MIN	0	0	—	—	—
BASE	33	COMDERUMB2 MAX	0	0	—	—	—
BASE	33	COMDERUMB2 MIN	0	0	—	—	—
N+6.95	34	COMDERUMB1 MAX	0,0122	0,0088	0,00861	0,25	OK
N+6.95	34	COMDERUMB1 MIN	-0,0122	-0,0088	0,00861	0,25	OK
N+6.95	34	COMDERUMB2 MAX	0,008	0,0197	0,01282	0,37	OK
N+6.95	34	COMDERUMB2 MIN	-0,008	-0,0197	0,01282	0,37	OK
N+3.45	34	COMDERUMB1 MAX	0,0055	0,0034	0,00647	0,18	OK
N+3.45	34	COMDERUMB1 MIN	-0,0055	-0,0034	0,00647	0,18	OK
N+3.45	34	COMDERUMB2 MAX	0,0035	0,0077	0,00846	0,24	OK
N+3.45	34	COMDERUMB2 MIN	-0,0035	-0,0077	0,00846	0,24	OK
BASE	34	COMDERUMB1 MAX	0	0	—	—	—
BASE	34	COMDERUMB1 MIN	0	0	—	—	—
BASE	34	COMDERUMB2 MAX	0	0	—	—	—
BASE	34	COMDERUMB2 MIN	0	0	—	—	—

7.2.6 VERIFICACION DE IRREGULARIDAD TORSIONAL

VERIFICACIÓN IRREGULARIDAD TORSIONAL

Story	Point	Load	UX	UY	UZ	Δ_1	*Irregularidad Torsional* $1.2*(\Delta_1+\Delta_2)/2$	*Irregularidad Torsional Extrema* $1.4*(\Delta_1+\Delta_2)/2$	I.T.Extrema≥Δ1 >I.T.?	Δ1>I.T.Extrema?
			m	m	m	m				
N+6.95	34	COMDER1 MAX	0,0467	0,035	0,0003	0,0332	0,0384	0,0448	NO	NO
N+6.95	34	COMDER1 MIN	-0,0467	-0,035	-0,0003	0,0332	0,0384	0,0448	NO	NO
N+6.95	34	COMDER2 MAX	0,0311	0,0771	0,0002	0,0498	0,0592	0,0691	NO	NO
N+6.95	34	COMDER2 MIN	-0,0311	-0,0771	-0,0002	0,0498	0,0592	0,0691	NO	NO
N+3.45	34	COMDER1 MAX	0,0211	0,0138	0,0002	0,0252	0,0288	0,0336	NO	NO
N+3.45	34	COMDER1 MIN	-0,0211	-0,0138	-0,0002	0,0252	0,0288	0,0336	NO	NO
N+3.45	34	COMDER2 MAX	0,0137	0,0304	0,0001	0,0333	0,0395	0,0461	NO	NO
N+3.45	34	COMDER2 MIN	-0,0137	-0,0304	-0,0001	0,0333	0,0395	0,0461	NO	NO
BASE	34	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	34	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	34	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	34	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

Story	Point	Load	UX	UY	UZ	Δ_1	*Irregularidad Torsional* $1.2*(\Delta_1+\Delta_2)/2$	*Irregularidad Torsional Extrema* $1.4*(\Delta_1+\Delta_2)/2$	I.T.Extrema≥Δ1 >I.T.?	Δ1>I.T.Extrema?
			m	m	m	m				
N+6.95	30	COMDER1 MAX	0,0404	0,035	0,0002	0,0307	0,0354	0,0413	NO	NO
N+6.95	30	COMDER1 MIN	-0,0404	-0,035	-0,0002	0,0307	0,0354	0,0413	NO	NO
N+6.95	30	COMDER2 MAX	0,0259	0,0771	0,0002	0,0489	0,0542	0,0632	NO	NO
N+6.95	30	COMDER2 MIN	-0,0259	-0,0771	-0,0002	0,0489	0,0542	0,0632	NO	NO
N+3.45	30	COMDER1 MAX	0,0182	0,0138	0,0002	0,0228	0,0266	0,0311	NO	NO
N+3.45	30	COMDER1 MIN	-0,0182	-0,0138	-0,0002	0,0228	0,0266	0,0311	NO	NO
N+3.45	30	COMDER2 MAX	0,0114	0,0304	0,0002	0,0325	0,0362	0,0422	NO	NO
N+3.45	30	COMDER2 MIN	-0,0114	-0,0304	-0,0002	0,0325	0,0362	0,0422	NO	NO
BASE	30	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	30	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	30	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	30	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

Story	Point	Load	UX	UY	UZ	Δ_1	*Irregularidad Torsional* $1.2*(\Delta_1+\Delta_2)/2$	*Irregularidad Torsional Extrema* $1.4*(\Delta_1+\Delta_2)/2$	I.T.Extrema≥Δ1 >I.T.?	Δ1>I.T.Extrema?
			m	m	m	m				
N+6.95	29	COMDER1 MAX	0,0404	0,029	0,0002	0,0283	0,0330	0,0385	NO	NO
N+6.95	29	COMDER1 MIN	-0,0404	-0,029	-0,0002	0,0283	0,0330	0,0385	NO	NO
N+6.95	29	COMDER2 MAX	0,0259	0,0642	0,0002	0,0414	0,0441	0,0515	NO	NO
N+6.95	29	COMDER2 MIN	-0,0259	-0,0642	-0,0002	0,0414	0,0441	0,0515	NO	NO
N+3.45	29	COMDER1 MAX	0,0182	0,0115	0,0001	0,0215	0,0255	0,0297	NO	NO
N+3.45	29	COMDER1 MIN	-0,0182	-0,0115	-0,0001	0,0215	0,0255	0,0297	NO	NO
N+3.45	29	COMDER2 MAX	0,0114	0,0254	0,0002	0,0278	0,0302	0,0352	NO	NO
N+3.45	29	COMDER2 MIN	-0,0114	-0,0254	-0,0002	0,0278	0,0302	0,0352	NO	NO
BASE	29	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	29	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	29	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	29	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

Story	Point	Load	UX	UY	UZ	Δ_2	*Irregularidad Torsional* 1.2*(Δ_1+Δ_2)/2	*Irregularidad Torsional Extrema* 1.4*(Δ_1+Δ_2)/2	I.T.Extrema≥Δ1 >I.T.?	Δ1>I.T.Extrema?
			m	m	m	m				
N+6.95	28	COMDER1 MAX	0,0404	0,0252	0,0001	0,0267	0,0329	0,0383	NO	NO
N+6.95	28	COMDER1 MIN	-0,0404	-0,0252	-0,0001	0,0267	0,0329	0,0383	NO	NO
N+6.95	28	COMDER2 MAX	0,0259	0,048	0,0002	0,0322	0,0367	0,0429	NO	NO
N+6.95	28	COMDER2 MIN	-0,0259	-0,048	-0,0002	0,0322	0,0367	0,0429	NO	NO
N+3.45	28	COMDER1 MAX	0,0182	0,0103	0,0001	0,0209	0,0259	0,0302	NO	NO
N+3.45	28	COMDER1 MIN	-0,0182	-0,0103	-0,0001	0,0209	0,0259	0,0302	NO	NO
N+3.45	28	COMDER2 MAX	0,0114	0,0193	0,0001	0,0224	0,0263	0,0307	NO	NO
N+3.45	28	COMDER2 MIN	-0,0114	-0,0193	-0,0001	0,0224	0,0263	0,0307	NO	NO
BASE	28	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	28	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	28	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	28	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

Story	Point	Load	UX	UY	UZ	Δ_2	*Irregularidad Torsional* 1.2*(Δ_1+Δ_2)/2	*Irregularidad Torsional Extrema* 1.4*(Δ_1+Δ_2)/2	I.T.Extrema≥Δ1 >I.T.?	Δ1>I.T.Extrema?
			m	m	m	m				
N+6.95	27	COMDER1 MAX	0,0404	0,0299	0,0001	0,0280	0,0354	0,0412	NO	NO
N+6.95	27	COMDER1 MIN	-0,0404	-0,0299	-0,0001	0,0280	0,0354	0,0412	NO	NO
N+6.95	27	COMDER2 MAX	0,0259	0,0434	0,0002	0,0291	0,0355	0,0414	NO	NO
N+6.95	27	COMDER2 MIN	-0,0259	-0,0434	-0,0002	0,0291	0,0355	0,0414	NO	NO
N+3.45	27	COMDER1 MAX	0,0182	0,0128	0,0001	0,0223	0,0281	0,0328	NO	NO
N+3.45	27	COMDER1 MIN	-0,0182	-0,0128	-0,0001	0,0223	0,0281	0,0328	NO	NO
N+3.45	27	COMDER2 MAX	0,0114	0,0182	0,0001	0,0215	0,0267	0,0311	NO	NO
N+3.45	27	COMDER2 MIN	-0,0114	-0,0182	-0,0001	0,0215	0,0267	0,0311	NO	NO
BASE	27	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	27	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	27	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	27	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

Story	Point	Load	UX	UY	UZ	Δ_2	*Irregularidad Torsional* 1.2*(Δ_1+Δ_2)/2	*Irregularidad Torsional Extrema* 1.4*(Δ_1+Δ_2)/2	I.T.Extrema≥Δ1 >I.T.?	Δ1>I.T.Extrema?
			m	m	m	m				
N+6.95	26	COMDER1 MAX	0,0404	0,038	0,0002	0,0309	0,0386	0,0450	NO	NO
N+6.95	26	COMDER1 MIN	-0,0404	-0,038	-0,0002	0,0309	0,0386	0,0450	NO	NO
N+6.95	26	COMDER2 MAX	0,0259	0,0464	0,0001	0,0301	0,0370	0,0432	NO	NO
N+6.95	26	COMDER2 MIN	-0,0259	-0,0464	-0,0001	0,0301	0,0370	0,0432	NO	NO
N+3.45	26	COMDER1 MAX	0,0182	0,0165	0,0001	0,0246	0,0308	0,0359	NO	NO
N+3.45	26	COMDER1 MIN	-0,0182	-0,0165	-0,0001	0,0246	0,0308	0,0359	NO	NO
N+3.45	26	COMDER2 MAX	0,0114	0,02	0,0001	0,0230	0,0284	0,0331	NO	NO
N+3.45	26	COMDER2 MIN	-0,0114	-0,02	-0,0001	0,0230	0,0284	0,0331	NO	NO
BASE	26	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	26	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	26	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	26	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

Story	Point	Load	UX	UY	UZ	Δ_1	*Irregularidad Torsional* 1.2*(Δ_1+Δ_2)/2	*Irregularidad Torsional Extrema* 1.4*(Δ_1+Δ_2)/2	I.T.Extrema≥Δ1 >I.T.?	Δ1>I.T.Extrema?
			m	m	m	m				
N+6.95	1	COMDER1 MAX	0,0467	0,038	0,0001	0,0334	0,0385	0,0450	NO	NO
N+6.95	1	COMDER1 MIN	-0,0467	-0,038	-0,0001	0,0334	0,0385	0,0450	NO	NO
N+6.95	1	COMDER2 MAX	0,0311	0,0464	0,0002	0,0316	0,0373	0,0436	NO	NO
N+6.95	1	COMDER2 MIN	-0,0311	-0,0464	-0,0002	0,0316	0,0373	0,0436	NO	NO
N+3.45	1	COMDER1 MAX	0,0211	0,0165	0,0001	0,0268	0,0309	0,0360	NO	NO
N+3.45	1	COMDER1 MIN	-0,0211	-0,0165	-0,0001	0,0268	0,0309	0,0360	NO	NO
N+3.45	1	COMDER2 MAX	0,0137	0,02	0,0001	0,0242	0,0282	0,0329	NO	NO
N+3.45	1	COMDER2 MIN	-0,0137	-0,02	-0,0001	0,0242	0,0282	0,0329	NO	NO
BASE	1	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	1	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	1	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	1	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

Story	Point	Load	UX	UY	UZ	Δ_1	*Irregularidad Torsional* 1.2*(Δ_1+Δ_2)/2	*Irregularidad Torsional Extrema* 1.4*(Δ_1+Δ_2)/2	I.T.Extrema≥Δ1 >I.T.?	Δ1>I.T.Extrema?
			m	m	m	m				
N+6.95	31	COMDER1 MAX	0,0467	0,0299	0,0001	0,0308	0,0362	0,0423	NO	NO
N+6.95	31	COMDER1 MIN	-0,0467	-0,0299	-0,0001	0,0308	0,0362	0,0423	NO	NO
N+6.95	31	COMDER2 MAX	0,0311	0,0434	0,0002	0,0306	0,0385	0,0449	NO	NO
N+6.95	31	COMDER2 MIN	-0,0311	-0,0434	-0,0002	0,0306	0,0385	0,0449	NO	NO
N+3.45	31	COMDER1 MAX	0,0211	0,0128	0,0001	0,0247	0,0289	0,0337	NO	NO
N+3.45	31	COMDER1 MIN	-0,0211	-0,0128	-0,0001	0,0247	0,0289	0,0337	NO	NO
N+3.45	31	COMDER2 MAX	0,0137	0,0182	0,0001	0,0228	0,0279	0,0325	NO	NO
N+3.45	31	COMDER2 MIN	-0,0137	-0,0182	-0,0001	0,0228	0,0279	0,0325	NO	NO
BASE	31	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	31	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	31	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	31	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

Story	Point	Load	UX	UY	UZ	Δ_1	*Irregularidad Torsional* 1.2*(Δ_1+Δ_2)/2	*Irregularidad Torsional Extrema* 1.4*(Δ_1+Δ_2)/2	I.T.Extrema≥Δ1 >I.T.?	Δ1>I.T.Extrema?
			m	m	m	m				
N+6.95	32	COMDER1 MAX	0,0467	0,0252	0,0001	0,0296	0,0364	0,0424	NO	NO
N+6.95	32	COMDER1 MIN	-0,0467	-0,0252	-0,0001	0,0296	0,0364	0,0424	NO	NO
N+6.95	32	COMDER2 MAX	0,0311	0,048	0,0002	0,0336	0,0457	0,0533	NO	NO
N+6.95	32	COMDER2 MIN	-0,0311	-0,048	-0,0002	0,0336	0,0457	0,0533	NO	NO
N+3.45	32	COMDER1 MAX	0,0211	0,0103	0,0001	0,0235	0,0285	0,0333	NO	NO
N+3.45	32	COMDER1 MIN	-0,0211	-0,0103	-0,0001	0,0235	0,0285	0,0333	NO	NO
N+3.45	32	COMDER2 MAX	0,0137	0,0193	0,0001	0,0237	0,0315	0,0368	NO	NO
N+3.45	32	COMDER2 MIN	-0,0137	-0,0193	-0,0001	0,0237	0,0315	0,0368	NO	NO
BASE	32	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	32	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	32	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	32	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

							Irregularidad Torsional	*Irregularidad Torsional Extrema*		
Story	**Point**	**Load**	**UX**	**UY**	**UZ**	Δ_1	$1.2*(\Delta_1+\Delta_2)/2$	$1.4*(\Delta_1+\Delta_2)/2$	**I.T.Extrema≥Δ1 >I.T.?**	**Δ1>I.T.Extrema?**
			m	m	m	m				
N+6.95	33	COMDER1 MAX	0,0467	0,029	0,0002	0,0310	0,0385	0,0450	NO	NO
N+6.95	33	COMDER1 MIN	-0,0467	-0,029	-0,0002	0,0310	0,0385	0,0450	NO	NO
N+6.95	33	COMDER2 MAX	0,0311	0,0642	0,0003	0,0425	0,0554	0,0647	NO	NO
N+6.95	33	COMDER2 MIN	-0,0311	-0,0642	-0,0003	0,0425	0,0554	0,0647	NO	NO
N+3.45	33	COMDER1 MAX	0,0211	0,0115	0,0001	0,0240	0,0295	0,0345	NO	NO
N+3.45	33	COMDER1 MIN	-0,0211	-0,0115	-0,0001	0,0240	0,0295	0,0345	NO	NO
N+3.45	33	COMDER2 MAX	0,0137	0,0254	0,0002	0,0289	0,0373	0,0435	NO	NO
N+3.45	33	COMDER2 MIN	-0,0137	-0,0254	-0,0002	0,0289	0,0373	0,0435	NO	NO
BASE	33	COMDER1 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	33	COMDER1 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	33	COMDER2 MAX	0	0	0	0,0000	0,0000	0,0000	NO	NO
BASE	33	COMDER2 MIN	0	0	0	0,0000	0,0000	0,0000	NO	NO

7.3 DISEÑO DE CIMENTACIÓN

7.3.1 ELECCIÓN DE CARGAS PARA DISEÑO DE CIMENTACIÓN

DISEÑO ESTRUCTURAL DE ZAPATAS CONCÉNTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA

BLOQUE C

CARGA ADMISIBLE 12.00 Ton/m² VERTICALES
CARGA ADMISIBLE S 15.96 Ton/m² SISMO

ZAPATA	B_X (m)	L_Y (m)	H (m)	Q_{MAX} (Ton/m²) CARGA VERTICAL	Q_{MAX} (Ton/m²) SISMO	Q_{MIN} (Ton/m²)	CHEQUEO	TIPO DE ZAPATA	REFUERZO EN X	REFUERZO EN Y
A-6	2.50	2.50	0.50	11.73	15.36	2.40	O.K.		17 VARILLAS No. 5 L = 2.4 m. @ 15 cm.	17 VARILLAS No. 5 L = 2.4 m. @ 15 cm.
A-7	2.50	2.50	0.50	11.20	15.12	2.65	O.K.		17 VARILLAS No. 5 L = 2.4 m. @ 15 cm.	17 VARILLAS No. 5 L = 2.4 m. @ 15 cm.
A-8	2.80	2.80	0.50	7.01	13.75	1.47	O.K.		25 VARILLAS No. 5 L = 2.7 m. @ 11.25 cm.	25 VARILLAS No. 5 L = 2.7 m. @ 11.25 cm.
A-9	2.80	2.80	0.50	3.86	11.17	0.26	O.K.		23 VARILLAS No. 5 L = 2.7 m. @ 12.27 cm.	23 VARILLAS No. 5 L = 2.7 m. @ 12.27 cm.
B'-5	2.90	2.90	0.50	3.03	11.42	2.95	O.K.		23 VARILLAS No. 5 L = 2.8 m. @ 12.73 cm.	23 VARILLAS No. 5 L = 2.8 m. @ 12.73 cm.
A-5	3.20	3.20	0.40	4.19	10.95	0.15	O.K.		28 VARILLAS No. 6 L = 3.1 m. @ 11.48 cm.	28 VARILLAS No. 6 L = 3.1 m. @ 11.48 cm.
B'-6	3.20	3.20	0.50	7.19	11.40	2.96	O.K.		20 VARILLAS No. 6 L = 3.1 m. @ 16.32 cm.	20 VARILLAS No. 6 L = 3.1 m. @ 16.32 cm.
B'-7	3.20	3.20	0.50	7.10	11.71	2.96	O.K.		21 VARILLAS No. 6 L = 3.1 m. @ 15.5 cm.	21 VARILLAS No. 6 L = 3.1 m. @ 15.5 cm.
B'-9	3.20	3.20	0.50	5.25	10.86	2.75	O.K.		24 VARILLAS No. 6 L = 3.1 m. @ 13.48 cm.	24 VARILLAS No. 6 L = 3.1 m. @ 13.48 cm.
B'-8	3.50	3.50	0.60	7.40	12.55	3.03	O.K.		20 VARILLAS No. 7 L = 3.4 m. @ 17.89 cm.	20 VARILLAS No. 7 L = 3.4 m. @ 17.89 cm.

7.3.2 DISEÑO VIGAS DE AMARRE

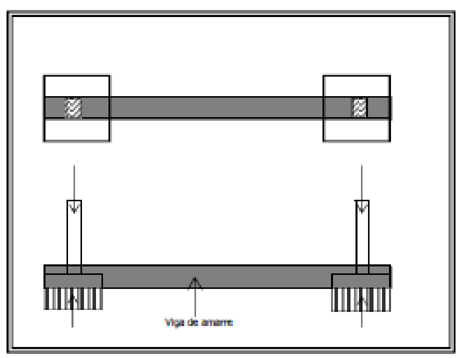
PROYECTO: I. E.ALFREDO BONILLA SEDE No. 2 MARÍA INMACULADA

VIGA DE AMARRE TIPO

f'c = **21,1** MPa
fy = **420** MPa

b = **0,30** m
h = **0,50** m

Pmáx = 893,12 kN



De acuerdo a el numeral A.3.6.4.2 de la NSR-10 tenemos:

Aa = *0,25*
Paxial = 0.25*Aa*Pmáx
Paxial = *55,820* kN

DISEÑO A TENSIÓN

As = 1.7*55.82/(0.90*420)
As = **2,51** cm²

DISEÑO A COMPRESIÓN

P com = 1.7*55.82
P com = *94,9* kN

Para esta carga la sección requiere cuantía mínima:

As = 0.00333*0.3*0.45
As = **4,50** cm²

Se suministra un refuerzo constituido por 3#5 arriba y abajo (como refuerzo mínimo).

7.3.3 DISEÑO DE ZAPATAS

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE C

ZAPATA CONCENTRICA No. A4

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	=	2.40	Ton/m³	d =	0.85	-
Peso unitario del suelo (γ_s)	=	1.80	Ton/m³	ϕv_c =	15.52	Kg/cm²
Capacidad admisible del suelo (q_{adm})	=	12.00	Ton/m²	α_s =	20.00	-
Profundidad de desplante (D)	=	1.50	m.	d =	32.50	cm.
Área columnas (A_c)	=	0.24	m²	b_o =	330.00	cm.
b_{col} (Sentido X)	=	40.00	cm	ϕv_c =	13.20	Kg/cm²
b_{col} (Sentido Y)	=	60.00	cm	ϕv_c =	13.55	Kg/cm²
	=	1.50	-			
f_y	=	4,200.00	Kg/cm²	ϕv_c (como losa) =	13.20	Kg/cm²
f'_c	=	210.00	Kg/cm²	ϕv_c (como viga) =	6.53	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		COMBINACIONES DE CARGA																
Ancho zapata en el sentido X (B)	m.	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
Largo zapata en el sentido Y (L)	m.	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
Relación B/L	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
β_c columna	cm.	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
b zapata	cm.	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
d	cm.	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
h zapata req.	m.	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
h	m.	**0.40**	**0.40**	**0.40**	**0.40**	**0.40**	**0.40**	**0.40**	**0.40**	**0.40**	**0.40**	**0.40**	**0.40**	**0.40**	**0.40**	**0.40**	**0.40**	**0.40**
d zapata	m.	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33
Área zapata (A)	m²	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24
Peso zapata	Ton	9.83	9.83	9.83	9.83	9.83	9.83	9.83	9.83	9.83	9.83	9.83	9.83	9.83	9.83	9.83	9.83	9.83
Peso suelo	Ton	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80
Pz	Ton	29.06	29.07	29.06	29.42	31.28	31.28	30.78	30.78	30.78	30.78	30.41	30.41	19.88	19.88	19.18	19.18	0.00
Peso total	Ton	58.63	58.70	58.68	59.06	60.99	60.99	60.41	60.41	60.39	60.39	60.04	60.04	49.29	49.29	48.81	48.81	29.63
Mx	Ton-m	-1.17	-0.95	-1.01	-4.02	9.49	9.49	12.01	12.01	7.08	7.08	8.99	8.99	9.95	9.95	12.49	12.49	0.00
Fy	Ton	-2.30	-2.35	-2.32	-1.49	1.44	1.44	2.31	2.31	0.59	0.59	1.16	1.16	2.36	2.36	3.23	3.23	0.00
My	Ton-m	2.53	3.17	3.26	3.76	15.23	15.23	11.34	11.34	12.27	12.27	8.12	8.12	13.92	13.92	9.83	9.83	0.00
Fx	Ton	3.44	3.35	3.37	3.50	7.69	7.69	8.15	8.15	8.60	8.60	5.43	5.43	6.21	6.21	4.78	4.78	0.00
M'x = Mx+Fy*hz	Ton-m	0.25	0.01	0.07	3.43	8.91	8.91	11.08	11.08	6.88	6.88	8.52	8.52	9.01	9.01	11.19	11.19	0.00
M'y = My+Fx*hz	Ton-m	4.90	4.81	4.81	5.16	18.41	18.41	13.70	13.70	14.84	14.84	11.29	11.29	16.45	16.45	11.74	11.74	0.00
ex = M'y/Wt	m.	0.08	0.08	0.08	0.09	0.30	0.30	0.23	0.23	0.25	0.25	0.19	0.19	0.33	0.33	0.24	0.24	0.00
ey = M'x/Wt	m.	0.00	0.00	0.00	0.06	0.15	0.15	0.18	0.18	0.11	0.11	0.14	0.14	0.18	0.18	0.23	0.23	0.00
6ex/B	-	0.16	0.14	0.15	0.16	0.57	0.57	0.43	0.43	0.46	0.46	0.35	0.35	0.63	0.63	0.45	0.45	0.00
6ey/L	-	0.01	0.00	0.00	0.11	0.27	0.27	0.34	0.34	0.21	0.21	0.27	0.27	0.34	0.34	0.43	0.43	0.00
q_{max}	Ton/m²	**6.87**	**5.56**	**5.59**	**7.34**	**10.95**	**10.95**	**10.44**	**10.44**	**8.88**	**8.88**	**8.48**	**8.48**	**8.47**	**8.47**	**8.87**	**8.87**	**2.89**
q_{min}	Ton/m²	**4.75**	**4.90**	**4.87**	**4.16**	**0.84**	**0.84**	**1.38**	**1.38**	**1.82**	**1.82**	**2.24**	**2.24**	**0.16**	**0.16**	**0.87**	**0.87**	**2.89**
CHEQUEO CAPACIDAD ADMISIBLE	-	O.K.																

DISEÑO ZAPATA - CARGAS MAYORADAS

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
P_u	Ton	-40.59	34.91	38.10	38.10	37.42	37.42	29.33	29.33	28.65	28.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peso total mayorado	Ton	82.08	88.02	89.21	89.21	88.53	88.53	80.44	80.44	59.76	59.76	31.11	31.11	31.11	31.11	31.11	31.11	31.11
Mx_u	Ton-m	-1.84	-1.05	14.94	14.04	17.85	17.85	14.17	14.17	17.78	17.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fy_u	Ton	-2.22	-2.83	2.52	2.52	2.79	2.79	3.27	3.27	4.52	4.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My_u	Ton-m	4.94	3.95	20.74	20.74	14.90	14.90	20.04	20.04	14.30	14.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fx_u	Ton	4.87	3.89	10.12	10.12	7.92	7.92	8.17	8.17	8.97	8.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'x_u$	Ton-m	2.40	2.18	15.05	15.05	19.18	19.18	15.47	15.47	19.59	19.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'y_u$	Ton-m	8.89	5.29	24.79	24.79	18.07	18.07	20.71	20.71	18.89	18.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{xu}	m.	0.08	0.08	0.38	0.38	0.26	0.26	0.39	0.39	0.28	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{yu}	m.	0.04	0.03	0.22	0.22	0.28	0.28	0.26	0.26	0.33	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{xu}/B$	-	0.16	0.15	0.87	0.87	0.49	0.49	0.74	0.74	0.53	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{yu}/L$	-	0.07	0.06	0.41	0.41	0.52	0.52	0.48	0.48	0.61	0.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$q_{max,u}$	Ton/m²	9.81	7.81	14.08	14.08	13.51	13.51	13.08	13.08	13.53	13.53	3.04	3.04	3.04	3.04	3.04	3.04	3.04
$q_{min,u}$	Ton/m²	6.23	5.08	-0.54	-0.54	-0.12	-0.12	-1.27	-1.27	-0.88	-0.88	3.04	3.04	3.04	3.04	3.04	3.04	3.04

ACCION COMO VIGA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
V_u	Ton	33.74	28.87	48.34	48.34	46.47	46.47	44.95	44.95	43.11	43.11	10.45	10.45	10.45	10.45	10.45	10.45	10.45
v_u	Kg/cm²	3.24	2.68	4.65	4.65	4.47	4.47	4.33	4.33	4.15	4.15	1.00	1.00	1.00	1.00	1.00	1.00	1.00
$v_u < \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN X - v_{umax}	Kg/cm²	4.65																
DIRECCION Y																		
V_u	Ton	30.60	24.57	43.85	43.85	42.15	42.15	40.80	40.80	39.10	39.10	9.48	9.48	9.48	9.48	9.48	9.48	9.48
v_u	Kg/cm²	2.94	2.34	4.22	4.22	4.05	4.05	3.92	3.92	3.76	3.76	0.91	0.91	0.91	0.91	0.91	0.91	0.91
$v_u < \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN Y - v_{umax}	Kg/cm²	4.22																

ACCION COMO LOSA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
b_o	cm.	330.00	330.00	330.00	330.00	330.00	330.00	330.00	330.00	330.00	330.00	330.00	330.00	330.00	330.00	330.00	330.00	330.00
V_u	Ton	93.08	74.15	134.48	134.48	128.26	128.26	125.13	125.13	119.93	119.93	28.07	28.07	28.07	28.07	28.07	28.07	28.07
v_u	Kg/cm²	8.75	6.97	12.54	12.54	12.05	12.05	11.67	11.67	11.18	11.18	2.71	2.71	2.71	2.71	2.71	2.71	2.71
$v_u < \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO LOSA - v_{umax}	Kg/cm²	12.54																

DISEÑO A FLEXION EN DOS DIRECCIONES

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
M_u	Ton-cm	**3,075.09**	**4,099.13**	**8,814.13**	**8,814.13**	**8,473.21**	**8,473.21**	**8,201.42**	**8,201.42**	**7,090.50**	**7,090.50**	**1,906.81**	**1,906.81**	**1,906.81**	**1,906.81**	**1,906.81**	**1,906.81**	**1,906.81**
K_u	Ton/cm²	0.00910	0.01469	0.02608	0.02608	0.02507	0.02507	0.02426	0.02426	0.02326	0.02326	0.00564	0.00564	0.00564	0.00564	0.00564	0.00564	0.00564
ρ > 0.0018	-	0.00249	0.00404	0.00750	0.00750	0.00727	0.00727	0.00703	0.00703	0.00670	0.00670	0.00152	0.00152	0.00152	0.00152	0.00152	0.00152	0.00152
A_{sx}	cm²	25.87	41.99	79.03	79.03	75.65	75.65	72.99	72.99	69.67	69.67	18.72	18.72	18.72	18.72	18.72	18.72	18.72
Longitud de varilla	cm.	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00
DIRECCION Y																		
M_u	Ton-cm	**5,504.33**	**4,224.34**	**7,599.93**	**7,599.93**	**7,305.90**	**7,305.90**	**7,071.83**	**7,071.83**	**6,777.80**	**6,777.80**	**1,643.10**	**1,643.10**	**1,643.10**	**1,643.10**	**1,643.10**	**1,643.10**	**1,643.10**
K_u	Ton/cm²	0.01589	0.01250	0.02249	0.02249	0.02162	0.02162	0.02093	0.02093	0.02005	0.02005	0.00486	0.00486	0.00486	0.00486	0.00486	0.00486	0.00486
ρ > 0.0018	-	0.00465	0.00366	0.00665	0.00665	0.00656	0.00656	0.00633	0.00633	0.00605	0.00605	0.00138	0.00138	0.00138	0.00138	0.00138	0.00138	0.00138
A_{sy}	cm²	25.87	41.99	79.03	79.03	75.65	75.65	72.99	72.99	69.67	69.67	18.72	18.72	18.72	18.72	18.72	18.72	18.72
Longitud de varilla	cm.	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	79.03
A_{sy} Máximo	cm²	79.03
EN SENTIDO X USAR	-	28 VARILLAS No. [illegible] L = 3.1 m. @ 11.48 cm.
EN SENTIDO Y USAR	-	28 VARILLAS No. [illegible] L = 3.1 m. @ 11.48 cm.

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE C

ZAPATA CONCENTRICA No. A4

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	=	2.40	Ton/m³	α =	3.00	-
Peso unitario del suelo (γ_s)	=	1.60	Ton/m³	$\phi v_c = \phi 0.27(2+4/\beta_c)(f'_c)^{0.5}$ =	15.52	Kg/cm²
Capacidad admisible del suelo (q_{adm})	=	12.00	Ton/m²	α_s =	20.00	-
Profundidad de desplante (D_f)	=	1.50	m	d =	42.50	cm
Área columnas (A_c)	=	0.24	m²	b_o =	370.00	cm
b_{col} (Sentido X)	=	40.00	cm	$\phi v_c = \phi 0.27(2+\alpha_s d/b_o)(f'_c)^{0.5}$ =	14.29	Kg/cm²
h_{col} (Sentido Y)	=	60.00	cm	$\phi v_c = \phi 1.1(f'_c)^{0.5}$ =	13.50	Kg/cm²
β_c	=	1.50	-			
f_y	=	4,200.00	Kg/cm²	ϕv_c (como losa) =	13.50	Kg/cm²
f'_c	=	210.00	Kg/cm²	$\phi v_c = \phi 0.53(f'_c)^{0.5}$ (como viga) =	6.53	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		COMBINACIONES DE CARGA																
Ancho zapata en el sentido X (B_x)	m	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Largo zapata en el sentido Y (L_y)	m	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
A_{req} / A_{zap}	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d_b columna	cm	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
d_b zapata	cm	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59
l_d	cm	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
h zapata req.	m	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57
h	m	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**
d zapata = (h - 0.075)	m	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43
Área zapata (A)	m²	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25
Peso zapata (W_z)	Ton	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50
Peso suelo (W_s)	Ton	10.82	10.82	10.82	10.82	10.82	10.82	10.82	10.82	10.82	10.82	10.82	10.82	10.82	10.82	10.82	10.82	10.82
Fz	Ton	42.64	42.75	42.72	43.89	43.62	43.62	44.21	44.21	43.47	43.47	43.92	43.92	26.57	26.57	27.76	27.76	0.00
Peso total (W_t = Fz+Wz+Ws)	Ton	60.96	61.07	61.04	62.21	61.94	61.94	62.53	62.53	61.79	61.79	62.23	62.23	44.89	44.89	45.48	45.48	18.32
Mx	Ton-m	2.27	2.08	2.15	0.70	7.98	7.98	8.90	8.90	8.22	8.22	7.79	7.79	8.92	8.92	8.85	8.85	0.00
Fy	Ton	-4.77	-4.88	-4.86	-4.20	-2.70	-2.70	-1.99	-1.99	-2.13	-2.13	-2.80	-2.80	-0.82	-0.82	-0.11	-0.11	0.00
My	Ton-m	-0.32	-0.47	-0.42	-0.22	4.07	4.07	2.57	2.57	2.89	2.89	1.77	1.77	4.19	4.19	2.70	2.70	0.00
Fx	Ton	-0.20	-0.28	-0.24	-0.19	1.80	1.80	1.11	1.11	1.27	1.27	0.75	0.75	1.88	1.88	1.19	1.19	0.00
M'x = Mx+Fy·h	Ton-m	4.73	4.60	4.48	2.80	8.23	8.23	10.80	10.80	7.89	7.89	9.08	9.08	7.32	7.32	8.81	8.81	0.00
M'y = My+Fx·h	Ton-m	0.42	0.56	0.55	0.30	4.97	4.97	3.13	3.13	3.53	3.53	2.14	2.14	5.13	5.13	3.30	3.30	0.00
e_x = M'y/W	m	0.01	0.01	0.01	0.00	0.08	0.08	0.05	0.05	0.06	0.06	0.03	0.03	0.11	0.11	0.07	0.07	0.00
e_y = M'x/W	m	0.08	0.07	0.07	0.05	0.15	0.15	0.17	0.17	0.13	0.13	0.15	0.15	0.16	0.16	0.20	0.20	0.00
$6e_x/B_x$	-	0.02	0.02	0.02	0.01	0.19	0.19	0.12	0.12	0.14	0.14	0.08	0.08	0.27	0.27	0.17	0.17	0.00
$6e_y/L_y$	-	0.19	0.17	0.18	0.11	0.36	0.36	0.41	0.41	0.31	0.31	0.35	0.35	0.39	0.39	0.47	0.47	0.00
q_{max} = (W/(B·L))(1+6ex/B+6ey/L)	Ton/m²	**11.72**	**11.69**	**11.70**	**11.14**	**15.38**	**15.38**	**15.38**	**15.38**	**14.27**	**14.27**	**14.27**	**14.27**	**11.97**	**11.97**	**11.96**	**11.96**	**2.93**
q_{min} = (W/(B·L))(1-6ex/B-6ey/L)	Ton/m²	**7.79**	**7.86**	**7.83**	**8.76**	**4.46**	**4.46**	**4.66**	**4.66**	**5.50**	**5.50**	**5.66**	**5.66**	**2.40**	**2.40**	**2.59**	**2.59**	**2.93**
CHEQUEO CAPACIDAD ADMISIBLE	-	O.K.																

DISEÑO ZAPATA - CARGAS MAYORADAS

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
F_{zu}	Ton	58.75	51.35	52.69	52.69	52.53	52.53	38.79	38.79	40.63	40.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peso total mayorado (W_{tu} = F_{zu}+W_{zu}+W_{su})	Ton	85.34	70.58	71.80	71.80	72.78	72.78	59.01	59.01	59.86	59.86	19.23	19.23	19.23	19.23	19.23	19.23	19.23
M_{xu}	Ton-m	3.32	2.88	10.40	10.40	13.17	13.17	9.96	9.96	12.75	12.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F_{yu}	Ton	-6.60	-5.54	-2.71	-2.71	-1.70	-1.70	-1.37	-1.37	-0.28	-0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M_{yu}	Ton-m	-0.45	-0.62	5.74	5.74	2.80	2.80	5.96	5.96	3.65	3.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F_{xu}	Ton	-0.26	-0.33	2.58	2.58	1.58	1.58	2.65	2.65	1.70	1.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M'_{xu} = M_{xu}+F_{yu}·h	Ton-m	8.60	8.15	11.76	11.76	14.03	14.03	10.67	10.67	12.93	12.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M'_{yu} = M_{yu}+F_{xu}·h	Ton-m	0.59	0.78	7.02	7.02	4.39	4.39	7.33	7.33	4.59	4.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{xu} = M'_{yu}/W_{tu}	m	0.01	0.01	0.10	0.10	0.06	0.06	0.12	0.12	0.08	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{yu} = M'_{xu}/W_{tu}	m	0.08	0.07	0.16	0.16	0.19	0.19	0.18	0.18	0.22	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{xu}/B_x$	-	0.02	0.03	0.23	0.23	0.14	0.14	0.30	0.30	0.19	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{yu}/L_y$	-	0.19	0.18	0.39	0.39	0.46	0.46	0.43	0.43	0.52	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00
q_{umax}	Ton/m²	16.40	13.57	18.73	18.73	18.71	18.71	16.36	16.36	18.34	18.34	3.08	3.08	3.08	3.08	3.08	3.08	3.08
q_{umin}	Ton/m²	10.89	9.01	4.30	4.30	4.57	4.57	2.54	2.54	2.81	2.81	3.08	3.08	3.08	3.08	3.08	3.08	3.08

ACCION COMO VIGA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
V_u	Ton	25.86	21.31	29.24	29.24	29.24	29.24	25.54	25.54	25.54	25.54	4.81	4.81	4.81	4.81	4.81	4.81	4.81
v_u	Kg/cm²	2.43	2.00	2.75	2.75	2.75	2.75	2.40	2.40	2.40	2.40	0.45	0.45	0.45	0.45	0.45	0.45	0.45
$v_u \le \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN X - v_{umax}	Kg/cm²	2.76																
DIRECCION Y																		
V_u	Ton	21.32	17.61	24.57	24.57	24.58	24.58	21.46	21.46	21.45	21.45	4.04	4.04	4.04	4.04	4.04	4.04	4.04
v_u	Kg/cm²	2.00	1.66	2.31	2.31	2.31	2.31	2.02	2.02	2.02	2.02	0.38	0.38	0.38	0.38	0.38	0.38	0.38
$v_u \le \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN Y - v_{umax}	Kg/cm²	2.31																

ACCION COMO LOSA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
b_o	cm	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00
V_u	Ton	88.75	73.38	101.15	101.15	101.12	101.12	88.35	88.35	88.33	88.33	16.63	16.63	16.63	16.63	16.63	16.63	16.63
v_u	Kg/cm²	5.64	4.66	6.43	6.43	6.43	6.43	5.62	5.62	5.62	5.62	1.06	1.06	1.06	1.06	1.06	1.06	1.06
$v_u \le \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO LOSA - v_{umax}	Kg/cm²	6.43																

DISEÑO A FLEXION EN DOS DIRECCIONES

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
M_{ux}	Ton-cm	**3,283.33**	**2,740.77**	**5,150.71**	**5,150.71**	**5,157.40**	**5,157.40**	**4,506.96**	**4,506.96**	**4,504.82**	**4,504.82**	**940.21**	**940.21**	**940.21**	**940.21**	**940.21**	**940.21**	**940.21**
K_u	Ton/cm²	0.00801	0.00828	0.01142	0.01142	0.01142	0.01142	0.00996	0.00996	0.00996	0.00996	0.00188	0.00188	0.00188	0.00188	0.00188	0.00188	0.00188
ρ_x	-	0.00185	0.00226	0.00315	0.00315	0.00315	0.00315	0.00274	0.00274	0.00273	0.00273	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
A_{sx}	cm²	19.13	23.99	33.45	33.45	33.44	33.44	29.07	29.07	29.05	29.05	19.13	19.13	19.13	19.13	19.13	19.13	19.13
Longitud de varilla = B_x - 10	cm	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00
DIRECCION Y																		
M_{uy}	Ton-cm	**2,755.32**	**3,062.17**	**4,223.09**	**4,223.09**	**4,221.81**	**4,221.81**	**3,690.56**	**3,690.56**	**3,687.45**	**3,687.45**	**864.34**	**864.34**	**864.34**	**864.34**	**864.34**	**864.34**	**864.34**
K_u	Ton/cm²	0.00821	0.00678	0.00935	0.00935	0.00935	0.00935	0.00817	0.00817	0.00817	0.00817	0.00154	0.00154	0.00154	0.00154	0.00154	0.00154	0.00154
ρ_y	-	0.00226	0.00184	0.00271	0.00271	0.00270	0.00270	0.00235	0.00235	0.00235	0.00235	0.00042	0.00042	0.00042	0.00042	0.00042	0.00042	0.00042
A_{sy}	cm²	19.13	23.99	33.45	33.45	33.44	33.44	29.07	29.07	29.05	29.05	19.13	19.13	19.13	19.13	19.13	19.13	19.13
Longitud de varilla = L_y - 10	cm	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	33.45
A_{sy} Máximo	cm²	33.45
EN SENTIDO X USAR	-	17 VARILLAS No. 5 L = 2.4 m. @ 15 cm.
EN SENTIDO Y USAR	-	17 VARILLAS No. 5 L = 2.4 m. @ 15 cm.

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE C

ZAPATA CONCENTRICA No. A-1

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	=	2.40	Ton/m³	ϕ =	0.85	-
Peso unitario del suelo (γ_s)	=	1.80	Ton/m³	ϕv_c =	15.57	Kg/cm²
Capacidad admisible del suelo (q_{adm})	=	12.00	Ton/m²	α_s =	20.00	-
Profundidad de desplante (D)	=	1.50	m	d =	42.50	cm
Area columnas (A_c)	=	0.24	m²	b_o =	370.00	cm
$b_{columna}$ (Sentido X)	=	40.00	cm	ϕv_c =	14.29	Kg/cm²
$h_{columna}$ (Sentido Y)	=	60.00	cm	$\phi v_c = \phi \cdot 1.1 \cdot f'_c{}^{0.5}$ =	13.55	Kg/cm²
β_c	=	1.50	-			
f_y	=	4,200.00	Kg/cm²	ϕv_c (como losa) =	13.55	Kg/cm²
f'_c	=	210.00	Kg/cm²	$\phi v_c = \phi \cdot 0.53 \cdot f'_c{}^{0.5}$ (como viga) =	6.53	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		COMBINACIONES DE CARGA																
Ancho zapata en el sentido X (B_x)	m	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Largo zapata en el sentido Y (L_y)	m	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
[illegible]	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_d columna	cm	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
L_d zapata	cm	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59
d = [illegible]	cm	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
h zapata (req. H = [illegible])	m	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57
h_z	m	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**
d zapata = (h_z - 0.075)	m	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43
Area zapata (A)	m²	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25
Peso zapata ($W_z = A \cdot h_z \cdot \gamma_c$)	Ton	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50
Peso suelo (W_s = [illegible])	Ton	10.82	10.82	10.82	10.82	10.82	10.82	10.82	10.82	10.82	10.82	10.82	10.82	10.82	10.82	10.82	10.82	10.82
Fz	Ton	41.97	41.89	41.91	43.32	43.09	43.09	43.77	43.77	42.78	42.78	43.27	43.27	26.30	26.30	26.98	26.98	0.00
Peso total (Wt = Fz+Ws+Wz)	Ton	60.29	60.21	60.23	61.64	61.41	61.41	62.09	62.09	61.08	61.08	61.59	61.59	44.62	44.62	45.30	45.30	18.32
Mx	Ton-m	1.71	0.85	1.14	0.28	5.99	5.99	8.12	8.12	4.09	4.09	6.70	6.70	0.21	0.21	8.44	8.44	0.00
Fy	Ton	-4.47	-4.27	-4.32	-4.08	-2.95	-2.95	-1.88	-1.88	-3.17	-3.17	-2.36	-2.36	-1.17	-1.17	-0.09	-0.09	0.00
My	Ton-m	-0.09	-0.23	-0.20	0.00	4.29	4.29	2.79	2.79	2.12	2.12	1.99	1.99	-4.21	4.21	2.63	2.63	0.00
Fx	Ton	0.00	-0.05	-0.04	0.04	1.99	1.99	1.30	1.30	1.47	1.47	0.95	0.95	1.99	1.99	1.30	1.30	0.00
M'x = Mx+Fy*hz	Ton-m	3.94	3.09	3.30	2.34	7.47	7.47	10.06	10.06	5.98	5.98	7.94	7.94	5.59	5.59	8.48	8.48	0.00
M'y = My+Fx*hz	Ton-m	0.09	0.26	0.21	0.03	5.27	5.27	3.44	3.44	3.85	3.85	2.47	2.47	5.21	5.21	3.48	3.48	0.00
e_x = M'y/Wt	m	0.00	0.00	0.00	0.00	0.09	0.09	0.06	0.06	0.06	0.06	0.04	0.04	0.12	0.12	0.08	0.08	0.00
e_y = M'x/Wt	m	0.07	0.05	0.05	0.04	0.12	0.12	0.16	0.16	0.10	0.10	0.13	0.13	0.13	0.13	0.19	0.19	0.00
$6e_x/B_x$	-	0.00	0.01	0.01	0.00	0.21	0.21	0.13	0.13	0.15	0.15	0.10	0.10	0.29	0.29	0.18	0.18	0.00
$6e_y/L_y$	-	0.16	0.12	0.13	0.09	0.29	0.29	0.39	0.39	0.23	0.23	0.31	0.31	0.32	0.32	0.45	0.45	0.00
q_{max} = [illegible]	Ton/m²	**11.20**	**10.60**	**10.69**	**10.79**	**14.72**	**14.72**	**16.12**	**16.12**	**13.55**	**13.55**	**13.08**	**13.08**	**11.44**	**11.44**	**11.04**	**11.04**	**2.93**
q_{min} = [illegible]	Ton/m²	**8.10**	**8.55**	**8.29**	**8.94**	**4.93**	**4.93**	**4.75**	**4.75**	**6.00**	**6.00**	**6.08**	**6.08**	**2.84**	**2.84**	**2.85**	**2.85**	**2.93**
CHEQUEO CAPACIDAD ADMISIBLE	-	O.K.																

DISEÑO ZAPATA - CARGAS MAYORADAS

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
$F_{z,u}$	Ton	58.75	56.34	51.09	51.09	52.65	52.65	39.38	39.38	40.34	40.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peso total mayorado (W_u = [illegible])	Ton	84.41	80.47	71.12	71.12	72.09	72.09	58.61	58.61	59.58	59.58	19.22	19.22	19.22	19.22	19.22	19.22	19.22
$M_{x,u}$	Ton-m	2.29	0.84	7.41	7.41	11.89	11.89	7.65	7.65	12.13	12.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$F_{y,u}$	Ton	-6.25	-5.05	-3.00	-3.00	-1.45	-1.45	-1.95	-1.95	-0.32	-0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M_{y,u}$	Ton-m	-0.12	-0.33	6.00	6.00	2.97	2.97	6.18	6.18	4.04	4.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$F_{x,u}$	Ton	0.00	-0.09	2.79	2.79	1.81	1.81	2.04	2.04	1.88	1.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'_{x,u}$ = [illegible]	Ton-m	5.52	3.38	8.91	8.91	12.62	12.62	8.58	8.58	12.29	12.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'_{y,u}$ = [illegible]	Ton-m	0.13	0.37	7.39	7.39	4.78	4.78	7.58	7.58	4.97	4.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{xu} = [illegible]	m	0.00	0.01	0.10	0.10	0.07	0.07	0.13	0.13	0.08	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{yu} = [illegible]	m	0.07	0.05	0.13	0.13	0.18	0.18	0.15	0.15	0.21	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{xu}/B_x$	-	0.00	0.01	0.25	0.25	0.16	0.16	0.31	0.31	0.20	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{yu}/L_y$	-	0.16	0.13	0.30	0.30	0.42	0.42	0.35	0.35	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$q_{u,max}$ = [illegible]	Ton/m²	15.60	12.55	17.84	17.84	18.21	18.21	15.58	15.58	16.16	16.16	3.08	3.08	3.08	3.08	3.08	3.08	3.08
$q_{u,min}$ = [illegible]	Ton/m²	11.34	9.68	5.12	5.12	4.85	4.85	3.17	3.17	2.91	2.91	3.08	3.08	3.08	3.08	3.08	3.08	3.08

ACCION COMO VIGA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
V_u = [illegible]	Ton	24.49	19.51	27.58	27.58	28.48	28.48	24.35	24.35	25.25	25.25	4.81	4.81	4.81	4.81	4.81	4.81	4.81
v_u = [illegible]	Kg/cm²	2.31	1.85	2.59	2.59	2.68	2.68	2.29	2.29	2.38	2.38	0.45	0.45	0.45	0.45	0.45	0.45	0.45
$v_u < \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN X - $v_{u,max}$	Kg/cm²	2.68																
DIRECCION Y																		
V_u = [illegible]	Ton	20.57	16.47	23.15	23.15	23.81	23.81	20.45	20.45	21.21	21.21	4.04	4.04	4.04	4.04	4.04	4.04	4.04
v_u = [illegible]	Kg/cm²	1.94	1.55	2.18	2.18	2.25	2.25	1.93	1.93	2.00	2.00	0.38	0.38	0.38	0.38	0.38	0.38	0.38
$v_u < \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN Y - $v_{u,max}$	Kg/cm²	2.25																

ACCION COMO LOSA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
b_o	cm	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00
V_u = [illegible]	Ton	84.71	67.83	95.33	95.33	98.44	98.44	84.22	84.22	87.33	87.33	16.63	16.63	16.63	16.63	16.63	16.63	16.63
v_u = [illegible]	Kg/cm²	5.39	4.31	6.06	6.06	6.26	6.26	5.36	5.36	5.55	5.55	1.06	1.06	1.06	1.06	1.06	1.06	1.06
$v_u < \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO LOSA - $v_{u,max}$	Kg/cm²	6.26																

DISEÑO A FLEXION EN DOS DIRECCIONES

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
M_{ux} = [illegible]	Ton-cm	**3,180.22**	**3,480.03**	**4,881.99**	**4,881.99**	**5,020.38**	**5,020.38**	**4,296.40**	**4,296.40**	**4,453.77**	**4,453.77**	**848.21**	**848.21**	**848.21**	**848.21**	**848.21**	**848.21**	**848.21**
R_u = [illegible]	Ton/cm²	0.00476	0.00768	0.01077	0.01077	0.01112	0.01112	0.00951	0.00951	0.00986	0.00986	0.00188	0.00188	0.00188	0.00188	0.00188	0.00188	0.00188
ρ = [illegible] ≥ 0.0018	-	0.00129	0.00208	0.00298	0.00298	0.00306	0.00306	0.00260	0.00260	0.00270	0.00270	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
A_{sx} = [illegible]	cm²	19.13	22.14	31.45	31.45	32.51	32.51	27.67	27.67	28.72	28.72	19.13	19.13	19.13	19.13	19.13	19.13	19.13
Longitud de varilla = Bx - 10	cm	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00
DIRECCION Y																		
M_{uy} = [illegible]	Ton-cm	**3,539.71**	**2,831.30**	**3,979.99**	**3,979.99**	**4,109.83**	**4,109.83**	**3,518.19**	**3,518.19**	**3,645.03**	**3,645.03**	**694.34**	**694.34**	**694.34**	**694.34**	**694.34**	**694.34**	**694.34**
R_u = [illegible]	Ton/cm²	0.00783	0.00627	0.00881	0.00881	0.00910	0.00910	0.00779	0.00779	0.00807	0.00807	0.00154	0.00154	0.00154	0.00154	0.00154	0.00154	0.00154
ρ = [illegible] ≥ 0.0018	-	0.00235	0.00179	0.00255	0.00255	0.00263	0.00263	0.00224	0.00224	0.00233	0.00233	0.00043	0.00043	0.00043	0.00043	0.00043	0.00043	0.00043
A_{sy} = [illegible]	cm²	19.13	22.14	31.45	31.45	32.51	32.51	27.67	27.67	28.72	28.72	19.13	19.13	19.13	19.13	19.13	19.13	19.13
Longitud de varilla = Ly - 10	cm	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	32.51
A_{sy} Máximo	cm²	32.51
EN SENTIDO X USAR	-	17 VARILLAS No. 5 L = 2.4 m. @ 15 cm.
EN SENTIDO Y USAR	-	17 VARILLAS No. 5 L = 2.4 m. @ 15 cm.

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE C

ZAPATA CONCENTRICA No. A4

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	= 2.40	Ton/m³	ϕ =	0.85	-
Peso unitario del suelo (γ_s)	= 1.80	Ton/m³	$\phi v_c = \phi \cdot 0.27 \cdot (2+4/\beta_c) \cdot (f'_c)^{1/2}$ =	15.52	Kg/cm²
Capacidad admisible del suelo (q_{adm})	= 12.00	Ton/m²	α_s =	20.00	-
Profundidad de desplante (D)	= 1.50	m	d =	42.50	cm
Area columnas (A_c)	= 0.24	m²	b_o =	370.00	cm
$b_{columna}$ (Sentido X)	= 40.00	cm	$\phi v_c = \phi \cdot 0.27 \cdot (2+\alpha_s d/b_o) \cdot (f'_c)^{1/2}$ =	14.29	Kg/cm²
$h_{columna}$ (Sentido Y)	= 60.00	cm	$\phi v_c = \phi \cdot 1.1 \cdot (f'_c)^{1/2}$ =	13.55	Kg/cm²
β_c	= 1.50	-			
f_y	= 4,200.00	Kg/cm²	ϕv_c (como losa) =	13.55	Kg/cm²
f'_c	= 210.00	Kg/cm²	$\phi v_c = \phi \cdot 0.53 \cdot (f'_c)^{1/2}$ (como viga) =	6.53	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		COMBINACIONES DE CARGA																
Ancho zapata en el sentido X (B_x)	m	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
Largo zapata en el sentido Y (L_y)	m	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
B_{zap}/L_{zap}	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
β_c columna	cm	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
β_c zapata	cm	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
d = ...	cm	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
h zapata rec.	m	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
h_z	m	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**
d zapata = (h_z - 0.075)	m	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43
Area zapata (A)	m²	7.84	7.84	7.84	7.84	7.84	7.84	7.84	7.84	7.84	7.84	7.84	7.84	7.84	7.84	7.84	7.84	7.84
Peso zapata (W_z)	Ton	9.41	9.41	9.41	9.41	9.41	9.41	9.41	9.41	9.41	9.41	9.41	9.41	9.41	9.41	9.41	9.41	9.41
Peso suelo (W_s)	Ton	13.68	13.68	13.68	13.68	13.68	13.68	13.68	13.68	13.68	13.68	13.68	13.68	13.68	13.68	13.68	13.68	13.68
Pz	Ton	42.62	48.07	47.78	46.46	46.74	46.74	47.26	47.26	49.98	49.98	50.37	50.37	29.21	29.21	29.73	29.73	0.00
Peso total (W_t = Pz+W_z+W_s)	Ton	65.71	71.15	70.87	69.55	69.83	69.83	70.35	70.35	73.06	73.06	73.46	73.46	52.30	52.30	52.82	52.82	23.09
Mx	Ton-m	-2.53	-4.66	-4.13	-4.01	4.26	4.26	11.95	11.95	1.09	1.09	6.64	6.64	5.25	5.25	12.96	12.96	0.00
Fy	Ton	-2.69	-1.92	-2.11	-2.27	-0.47	-0.47	1.99	1.99	-0.43	-0.43	1.43	1.43	0.61	0.61	2.05	2.05	0.00
My	Ton-m	-2.29	-3.02	-2.87	-2.11	10.17	10.17	5.86	5.86	6.65	6.65	3.39	3.39	11.13	11.13	8.82	8.82	0.00
Fx	Ton	-1.66	-2.19	-2.11	-1.76	2.07	2.07	1.33	1.33	1.62	1.62	-0.31	-0.31	3.81	3.81	2.07	2.07	0.00
M'x = Mx+Fy·h_z	Ton-m	1.19	3.09	3.07	2.88	4.57	4.57	10.96	10.96	1.31	1.31	6.13	6.13	5.05	5.05	11.43	11.43	0.00
M'y = My+Fx·h_z	Ton-m	3.31	4.12	3.60	3.00	11.71	11.71	8.53	8.53	7.46	7.46	3.55	3.55	13.03	13.03	7.85	7.85	0.00
e_x = M'y/W_t	m	0.05	0.06	0.06	0.04	0.17	0.17	0.09	0.09	0.10	0.10	0.05	0.05	0.25	0.25	0.15	0.15	0.00
e_y = M'x/W_t	m	0.02	0.05	0.04	0.04	0.07	0.07	0.16	0.16	0.02	0.02	0.08	0.08	0.10	0.10	0.22	0.22	0.00
6e_x/B_x	-	0.11	0.13	0.12	0.10	0.36	0.36	0.20	0.20	0.22	0.22	0.10	0.10	0.53	0.53	0.33	0.33	0.00
6e_y/L_y	-	0.04	0.11	0.09	0.09	0.14	0.14	0.33	0.33	0.04	0.04	0.18	0.18	0.21	0.21	0.48	0.48	0.00
q_{max}	Ton/m²	**8.76**	**11.34**	**10.96**	**10.32**	**13.36**	**13.36**	**13.75**	**13.75**	**11.72**	**11.72**	**12.01**	**12.01**	**11.81**	**11.81**	**12.01**	**12.01**	**2.94**
q_{min}	Ton/m²	**7.20**	**7.07**	**7.13**	**7.51**	**4.46**	**4.46**	**4.18**	**4.18**	**5.82**	**5.82**	**6.72**	**6.72**	**1.73**	**1.73**	**1.47**	**1.47**	**2.94**
CHEQUEO CAPACIDAD ADMISIBLE	-	O.K.																
DISEÑO ZAPATA - CARGAS MAYORADAS																		
P_u	Ton	61.35	60.89	62.01	62.01	62.75	62.75	43.61	43.61	44.38	44.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peso total mayorado (W_{tu})	Ton	83.67	85.53	86.25	86.25	87.00	87.00	67.85	67.85	68.60	68.60	24.24	24.24	24.24	24.24	24.24	24.24	24.24
Mx_u	Ton-m	-2.54	-5.44	4.65	4.65	15.53	15.53	7.52	7.52	19.41	19.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fy_u	Ton	-2.76	-2.01	0.71	0.71	4.22	4.22	0.75	0.75	4.26	4.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My_u	Ton-m	-3.24	-3.89	14.44	14.44	8.28	8.28	15.79	15.79	9.64	9.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fx_u	Ton	-2.60	-2.77	4.47	4.47	1.99	1.99	5.86	5.86	2.99	2.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'x_u$ = Mx_u+Fy_u·h_z	Ton-m	5.40	7.44	5.00	5.00	17.63	17.63	7.91	7.91	20.54	20.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'y_u$ = My_u+Fx_u·h_z	Ton-m	4.64	5.27	16.67	16.67	9.27	9.27	18.48	18.48	11.08	11.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{xu} = $M'y_u$/W_{tu}	m	0.05	0.06	0.19	0.19	0.11	0.11	0.27	0.27	0.16	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{yu} = $M'x_u$/W_{tu}	m	0.06	0.09	0.06	0.06	0.20	0.20	0.12	0.12	0.30	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6e_{xu}/B_x	-	0.11	0.13	0.41	0.41	0.23	0.23	0.58	0.58	0.35	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6e_{yu}/L_y	-	0.12	0.19	0.12	0.12	0.43	0.43	0.25	0.25	0.64	0.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00
q_{umax}	Ton/m²	14.70	14.35	16.60	16.60	15.45	15.45	15.87	15.87	17.38	17.38	3.09	3.09	3.09	3.09	3.09	3.09	3.09
q_{umin}	Ton/m²	9.30	7.60	5.08	5.08	3.74	3.74	1.44	1.44	0.11	0.11	3.09	3.09	3.09	3.09	3.09	3.09	3.09
ACCION COMO VIGA																		
DIRECCION X																		
V_u	Ton	31.69	31.13	28.73	28.73	40.04	40.04	34.43	34.43	37.74	37.74	6.71	6.71	6.71	6.71	6.71	6.71	6.71
v_u = V_u/(L_y·d)	Kg/cm²	2.66	2.63	3.09	3.09	3.38	3.38	2.84	2.84	3.17	3.17	0.56	0.56	0.56	0.56	0.56	0.56	0.56
v_u ≤ ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN X - v_{umax}	Kg/cm²	**3.38**																
DIRECCION Y																		
V_u	Ton	27.78	27.13	31.66	31.66	34.87	34.87	29.99	29.99	32.87	32.87	5.84	5.84	5.84	5.84	5.84	5.84	5.84
v_u = V_u/(B_x·d)	Kg/cm²	2.33	2.28	2.66	2.66	2.93	2.93	2.52	2.52	2.76	2.76	0.49	0.49	0.49	0.49	0.49	0.49	0.49
v_u ≤ ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN Y - v_{umax}	Kg/cm²	**2.93**																
ACCION COMO LOSA																		
b_o	cm	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00
V_u	Ton	102.65	100.35	118.28	118.28	128.05	128.05	110.98	110.98	121.65	121.65	21.63	21.63	21.63	21.63	21.63	21.63	21.63
v_u = V_u/(b_o·d)	Kg/cm²	6.54	6.38	7.53	7.53	8.21	8.21	7.06	7.06	7.74	7.74	1.38	1.38	1.38	1.38	1.38	1.38	1.38
v_u ≤ ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO LOSA - v_{umax}	Kg/cm²	**8.21**																
DISEÑO A FLEXION EN DOS DIRECCIONES																		
DIRECCION X																		
M_{ux}	Ton-cm	**3,983.00**	**5,754.83**	**8,624.20**	**8,624.20**	**7,436.20**	**7,436.20**	**8,387.45**	**8,387.45**	**7,012.56**	**7,012.56**	**1,246.75**	**1,246.75**	**1,246.75**	**1,246.75**	**1,246.75**	**1,246.75**	**1,246.75**
K_u = M_u/(L_y·d²)	Ton/cm²	0.00586	0.01144	0.01349	0.01349	0.01471	0.01471	0.01265	0.01265	0.01387	0.01387	0.00247	0.00247	0.00247	0.00247	0.00247	0.00247	0.00247
ρ_x ≥ 0.0018	-	0.00156	0.00315	0.00375	0.00375	0.00410	0.00410	0.00350	0.00350	0.00385	0.00385	0.00066	0.00066	0.00066	0.00066	0.00066	0.00066	0.00066
A_{sx} = ρ_x·L_y·d	cm²	21.42	37.51	44.57	44.57	48.80	48.80	41.66	41.66	45.86	45.86	21.42	21.42	21.42	21.42	21.42	21.42	21.42
Longitud de varilla = B_x - 10	cm	270.00	270.00	270.00	270.00	270.00	270.00	270.00	270.00	270.00	270.00	270.00	270.00	270.00	270.00	270.00	270.00	270.00
DIRECCION Y																		
M_{uy}	Ton-cm	**4,979.57**	**4,880.72**	**5,734.22**	**5,734.22**	**6,281.06**	**6,281.06**	**5,376.66**	**5,376.66**	**5,892.50**	**5,892.50**	**1,047.82**	**1,047.82**	**1,047.82**	**1,047.82**	**1,047.82**	**1,047.82**	**1,047.82**
K_u = M_u/(B_x·d²)	Ton/cm²	0.00985	0.00961	0.01134	0.01134	0.01236	0.01236	0.01063	0.01063	0.01165	0.01165	0.00207	0.00207	0.00207	0.00207	0.00207	0.00207	0.00207
ρ_y ≥ 0.0018	-	0.00266	0.00279	0.00330	0.00330	0.00362	0.00362	0.00309	0.00309	0.00340	0.00340	0.00058	0.00058	0.00058	0.00058	0.00058	0.00058	0.00058
A_{sy} = ρ_y·B_x·d	cm²	21.42	37.51	44.57	44.57	48.80	48.80	41.66	41.66	45.86	45.86	21.42	21.42	21.42	21.42	21.42	21.42	21.42
Longitud de varilla = L_y - 10	cm	270.00	270.00	270.00	270.00	270.00	270.00	270.00	270.00	270.00	270.00	270.00	270.00	270.00	270.00	270.00	270.00	270.00

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	48.80
A_{sy} Máximo	cm²	48.80
EN SENTIDO X USAR	-	25 VARILLAS No. 5 L = 2.7 m. @ 11.25 cm.
EN SENTIDO Y USAR	-	25 VARILLAS No. 5 L = 2.7 m. @ 11.25 cm.

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE C

ZAPATA CONCENTRICA No. A8

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	= 2.40	Ton/m³		α =	0.85	-
Peso unitario del suelo (γ_s)	= 1.80	Ton/m³			15.52	Kg/cm²
Capacidad admisible del suelo (q_{adm})	= 12.00	Ton/m²			20.00	-
Profundidad de desplante (D)	= 1.50	m.			42.50	cm.
Area columnas (A_c)	= 0.24	m²			370.00	cm.
(Sentido X)	= 40.00	cm.			14.29	Kg/cm²
(Sentido Y)	= 60.00	cm.			13.55	Kg/cm²
	= 1.50	-				
f_y	= 4,200.00	Kg/cm²		(como losa) =	13.55	Kg/cm²
f'_c	= 210.00	Kg/cm²		(como viga) =	8.53	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION | UNIDADES | COMBINACIONES DE CARGA 1–17

CHEQUEO CAPACIDAD ADMISIBLE: O.K.

DISEÑO ZAPATA - CARGAS MAYORADAS

ACCION COMO VIGA

DIRECCION X

CHEQUEO ACCION COMO VIGA EN X - $V_{c\,max}$ Kg/cm² 3.06

DIRECCION Y

CHEQUEO ACCION COMO VIGA EN Y - $V_{c\,max}$ Kg/cm² 2.68

ACCION COMO LOSA

CHEQUEO ACCION COMO LOSA - $V_{c\,max}$ Kg/cm² 7.48

DISEÑO A FLEXION EN DOS DIRECCIONES

DIRECCION X

DIRECCION Y

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	44.15
A_{sy} Máximo	cm²	44.15
EN SENTIDO X USAR	-	22 VARILLAS No. 5 L = 2.7 m. @ 12.27 cm.
EN SENTIDO Y USAR	-	22 VARILLAS No. 5 L = 2.7 m. @ 12.27 cm.

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE C

ZAPATA CONCENTRICA No. [illegible]

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	= 2.40	Ton/m³	α =	3.85	-
Peso unitario del suelo (γ_s)	= 1.80	Ton/m³	ϕv_c = [illegible] =	15.52	Kg/cm²
Capacidad admisible del suelo (q_{adm})	= 12.00	Ton/m²	α_s =	20.00	-
Profundidad de desplante (Df)	= 1.50	m	d =	42.50	cm
Área columnas (A_c)	= 0.24	m²	b_o =	370.00	cm
$L_{columna}$ (Sentido X)	= 40.00	cm	ϕv_c = [illegible] =	14.26	Kg/cm²
$L_{columna}$ (Sentido Y)	= 60.00	cm	ϕv_c = [illegible] =	13.55	Kg/cm²
β_c	= 1.50	-			
f_y	= 4,200.00	Kg/cm²	ϕv_c (como losa) =	13.55	Kg/cm²
f'_c	= 210.00	Kg/cm²	ϕv_c = [illegible] (como viga) =	6.52	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		COMBINACIONES DE CARGA																
Ancho zapata en el sentido X (B_x)	m.	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90
Largo zapata en el sentido Y (L_y)	m.	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90
B_{zap} / L_{zap}	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d_b columna	cm.	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
d_b zapata	cm.	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59
l_d = [illegible]	cm.	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
h zapata req. H = [illegible]	m.	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57
h_z	m.	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**
d zapata = (h_z - 0.075)	m.	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43
Área zapata (A)	m²	8.41	8.41	8.41	8.41	8.41	8.41	8.41	8.41	8.41	8.41	8.41	8.41	8.41	8.41	8.41	8.41	8.41
Peso zapata (W_z = [illegible])	Ton	10.09	10.09	10.09	10.09	10.09	10.09	10.09	10.09	10.09	10.09	10.09	10.09	10.09	10.09	10.09	10.09	10.09
Peso suelo (W_s = [illegible])	Ton	14.71	14.71	14.71	14.71	14.71	14.71	14.71	14.71	14.71	14.71	14.71	14.71	14.71	14.71	14.71	14.71	14.71
Pz	Ton	28.05	28.18	28.12	27.93	29.35	29.35	29.85	29.85	29.12	29.12	29.50	29.50	24.13	24.13	24.53	24.53	0.00
Peso total (W_t = Pz+Wz+Ws)	Ton	52.85	52.98	52.92	52.73	54.15	54.15	54.65	54.65	53.92	53.92	54.30	54.30	48.93	48.93	49.33	49.33	24.80
Mx	Ton-m	-6.26	-6.19	-6.14	-6.22	1.08	1.08	2.82	2.82	-0.57	-0.57	0.74	0.74	3.58	3.58	5.32	5.32	0.00
Fy	Ton	2.37	3.33	3.38	3.96	6.05	6.05	6.70	6.70	5.28	5.28	5.86	5.86	4.72	4.72	5.35	5.35	0.00
My	Ton-m	5.52	5.64	5.81	5.44	10.12	10.12	8.59	8.59	8.10	8.10	7.94	7.94	7.91	7.91	6.39	6.39	0.00
Fx	Ton	4.73	4.77	4.78	4.71	6.67	6.67	6.02	6.02	6.23	6.23	5.74	5.74	4.78	4.78	4.12	4.12	0.00
M'x = Mx+Fy*h_z	Ton-m	7.94	7.78	7.81	10.21	1.98	1.98	0.53	0.53	3.28	3.28	2.18	2.18	1.22	1.22	3.88	3.88	0.00
M'y = My+Fx*h_z	Ton-m	7.88	9.03	7.99	7.80	13.45	13.45	11.80	11.80	12.21	12.21	10.61	10.61	10.30	10.30	8.45	8.45	0.00
e_x = M'y/W_t	m.	0.13	0.13	0.13	0.15	0.21	0.21	0.16	0.16	0.16	0.16	0.17	0.17	0.21	0.21	0.17	0.17	0.00
e_y = M'x/W_t	m.	0.12	0.12	0.12	0.16	0.03	0.03	0.01	0.01	0.05	0.05	0.03	0.03	0.02	0.02	0.05	0.05	0.00
$6e_x/B_x$	-	0.26	0.26	0.28	0.28	0.43	0.43	0.37	0.37	0.40	0.40	0.35	0.35	0.44	0.44	0.35	0.35	0.00
$6e_y/L_y$	-	0.26	0.25	0.26	0.34	0.06	0.06	0.02	0.02	0.11	0.11	0.07	0.07	0.05	0.05	0.11	0.11	0.00
q_{max} = [illegible]	Ton/m²	**11.37**	**11.37**	**11.37**	**11.86**	**11.42**	**11.42**	**10.87**	**10.87**	**11.41**	**11.41**	**10.04**	**10.04**	**8.85**	**8.85**	**8.81**	**8.81**	**2.95**
q_{min} = [illegible]	Ton/m²	**3.80**	**3.80**	**3.80**	**3.55**	**3.94**	**3.94**	**4.73**	**4.73**	**3.79**	**3.79**	**4.45**	**4.45**	**2.95**	**2.95**	**3.16**	**3.16**	**2.95**
CHEQUEO CAPACIDAD ADMISIBLE	-	O.K.																
DISEÑO ZAPATA - CARGAS MAYORADAS																		
P_u	Ton	52.27	45.84	47.62	47.62	49.25	49.25	38.10	38.10	38.82	38.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peso total mayorado (W_{tu} = [illegible])	Ton	67.98	71.88	73.67	73.67	74.38	74.38	62.14	62.14	62.88	62.88	26.04	26.04	26.04	26.04	26.04	26.04	26.04
Mx_u	Ton-m	-6.78	-7.25	3.12	3.12	5.62	5.62	4.85	4.85	7.33	7.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fy_u	Ton	4.75	3.87	7.85	7.85	6.75	6.75	6.88	6.88	7.79	7.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My_u	Ton-m	7.73	8.82	13.32	13.20	11.14	11.14	11.54	11.54	9.36	9.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fx_u	Ton	6.82	5.74	8.49	8.49	7.55	7.55	7.03	7.03	8.09	8.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'x_u$ = Mx_u+Fy_u*h_z	Ton-m	11.12	9.24	7.08	7.08	10.00	10.00	8.29	8.29	11.23	11.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'y_u$ = My_u+Fx_u*h_z	Ton-m	11.04	9.69	17.58	17.58	14.90	14.90	15.05	15.05	12.40	12.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{xu} = $M'y_u$/W_{tu}	m.	0.13	0.13	0.24	0.24	0.20	0.20	0.24	0.24	0.20	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{yu} = $M'x_u$/W_{tu}	m.	0.13	0.13	0.10	0.10	0.13	0.13	0.13	0.13	0.18	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{xu}/B_x$	-	0.26	0.26	0.49	0.49	0.41	0.41	0.50	0.50	0.41	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{yu}/L_y$	-	0.26	0.27	0.20	0.20	0.28	0.28	0.28	0.28	0.37	0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00
q_{umax} = [illegible]	Ton/m²	15.91	13.20	14.62	14.62	14.67	14.67	13.13	13.13	13.29	13.29	3.10	3.10	3.10	3.10	3.10	3.10	3.10
q_{umin} = [illegible]	Ton/m²	5.01	3.88	2.73	2.73	2.72	2.72	1.65	1.65	1.98	1.98	3.10	3.10	3.10	3.10	3.10	3.10	3.10
ACCION COMO VIGA																		
DIRECCION X																		
V_u = [illegible]	Ton	36.07	31.58	35.45	35.45	35.82	35.82	31.41	31.41	31.79	31.79	7.41	7.41	7.41	7.41	7.41	7.41	7.41
v_u = V_u/(L_y*d)	Kg/cm²	3.09	2.58	2.88	2.88	2.91	2.91	2.55	2.55	2.58	2.58	0.60	0.60	0.60	0.60	0.60	0.60	0.60
$v_u \le \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN X - v_{umax}	Kg/cm²	**3.09**																
DIRECCION Y																		
V_u = [illegible]	Ton	33.46	27.78	31.18	31.18	31.48	31.48	27.61	27.61	27.94	27.94	6.51	6.51	6.51	6.51	6.51	6.51	6.51
v_u = V_u/(B_x*d)	Kg/cm²	2.71	2.26	2.53	2.53	2.55	2.55	2.24	2.24	2.27	2.27	0.53	0.53	0.53	0.53	0.53	0.53	0.53
$v_u \le \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN Y - v_{umax}	Kg/cm²	**2.71**																
ACCION COMO LOSA																		
b_o	cm.	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00
V_u = [illegible]	Ton	100.37	99.88	113.07	113.07	113.36	113.36	99.33	99.33	100.51	100.51	20.42	20.42	20.42	20.42	20.42	20.42	20.42
v_u = V_u/(b_o*d)	Kg/cm²	7.85	6.36	7.19	7.19	7.20	7.20	6.32	6.32	6.39	6.39	1.49	1.49	1.49	1.49	1.49	1.49	1.49
$v_u \le \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO LOSA - v_{umax}	Kg/cm²	**7.85**																
DISEÑO A FLEXION EN DOS DIRECCIONES																		
DIRECCION X																		
M_{ux} = [illegible]	Ton-cm	**3,605.06**	**5,902.14**	**6,713.49**	**6,713.49**	**6,754.85**	**6,754.85**	**5,849.75**	**5,849.75**	**6,020.87**	**6,020.87**	**1,402.90**	**1,402.90**	**1,402.90**	**1,402.90**	**1,402.90**	**1,402.90**	**1,402.90**
K_u = [illegible]	Ton/cm²	0.00896	0.01142	0.01292	0.01292	0.01295	0.01295	0.01136	0.01136	0.01149	0.01149	0.00268	0.00268	0.00268	0.00268	0.00268	0.00268	0.00268
ρ_x = [illegible] ≥ 0.0018	-	0.00187	0.00215	0.00255	0.00255	0.00259	0.00259	0.00212	0.00212	0.00217	0.00217	0.00072	0.00072	0.00072	0.00072	0.00072	0.00072	0.00072
A_{sx} = ρ_x*L_y*d	cm²	33.02	38.79	43.74	43.74	44.23	44.23	38.57	38.57	39.05	39.05	22.19	22.19	22.19	22.19	22.19	22.19	22.19
Longitud de varilla = Bx - 10	cm.	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00
DIRECCION Y																		
M_{uy} = [illegible]	Ton-cm	**6,100.15**	**5,064.12**	**5,892.30**	**5,892.30**	**5,742.56**	**5,742.56**	**5,058.55**	**5,058.55**	**5,095.15**	**5,095.15**	**1,187.42**	**1,187.42**	**1,187.42**	**1,187.42**	**1,187.42**	**1,187.42**	**1,187.42**
K_u = [illegible]	Ton/cm²	0.01195	0.00967	0.01085	0.01085	0.01096	0.01096	0.00961	0.00961	0.00973	0.00973	0.00227	0.00227	0.00227	0.00227	0.00227	0.00227	0.00227
ρ_y = [illegible] ≥ 0.0018	-	0.00240	0.00280	0.00315	0.00315	0.00319	0.00319	0.00276	0.00276	0.00282	0.00282	0.00064	0.00064	0.00064	0.00064	0.00064	0.00064	0.00064
A_{sy} = ρ_y*B_x*d	cm²	33.02	38.79	43.74	43.74	44.23	44.23	38.57	38.57	39.05	39.05	22.19	22.19	22.19	22.19	22.19	22.19	22.19
Longitud de varilla = Ly - 10	cm.	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00	280.00
REFUERZO REQUERIDO																		
A_{sx} Máximo	cm²	**44.23**																
A_{sy} Máximo	cm²	**44.23**																
EN SENTIDO X USAR	-	**23 VARILLAS No. 5 L = 2.8 m. @ 12.75 cm.**																
EN SENTIDO Y USAR	-	**23 VARILLAS No. 5 L = 2.8 m. @ 12.75 cm.**																

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE C

ZAPATA CONCENTRICA No. Z-6

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	= 2.40	Ton/m³		β =	0.85	-
Peso unitario del suelo (γ_s)	= 1.80	Ton/m³	$\phi v_c = \phi 0.27(2+4/\beta_c)\sqrt{f'_c}$ =		15.52	Kg/cm²
Capacidad admisible del suelo (q_{adm})	= 12.00	Ton/m²		α_s =	20.00	-
Profundidad de desplante (D)	= 1.50	m		d =	42.50	cm
Area columnas (A_c)	= 0.24	m²		b_o =	370.00	cm
$b_{columna}$ (Sentido X)	= 40.00	cm	$\phi v_c = \phi 0.27(2+\alpha_s d/b_o)\sqrt{f'_c}$ =		14.29	Kg/cm²
$h_{columna}$ (Sentido Y)	= 60.00	cm	$\phi v_c = \phi 1.1\sqrt{f'_c}$ =		13.55	Kg/cm²
β_c	= 1.50	-				
f_y	= 4,200.00	Kg/cm²	ϕv_c (como losa) =		13.55	Kg/cm²
f'_c	= 210.00	Kg/cm²	$\phi v_c = \phi 0.53\sqrt{f'_c}$ (como viga) =		6.53	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Ancho zapata en el sentido X (B_x)	m	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
Largo zapata en el sentido Y (L_y)	m	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
R_{max} / R_{min}	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
l_d columna	cm	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
l_d zapata	cm	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
l_d	cm	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
h zapata req.	m	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57
h_z	m	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
d zapata = (h_z - 0.075)	m	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43
Area zapata (A)	m²	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24
Peso zapata	Ton	12.29	12.29	12.29	12.29	12.29	12.29	12.29	12.29	12.29	12.29	12.29	12.29	12.29	12.29	12.29	12.29	12.29
Peso suelo	Ton	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00
Fy	Ton	65.79	[illegible]	[illegible]	65.11	67.09	67.09	67.37	67.37	[illegible]	[illegible]	67.20	67.20	40.78	40.78	41.06	41.06	0.00
Peso total	Ton	[illegible]	[illegible]	[illegible]	[illegible]	97.37	97.37	[illegible]	[illegible]	97.27	97.27	[illegible]	[illegible]	71.06	71.06	71.35	71.35	[illegible]
CHEQUEO CAPACIDAD ADMISIBLE	-	O.K.																

DISEÑO ZAPATA - CARGAS MAYORADAS

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Fz_u	Ton	[illegible]	[illegible]	81.08	81.08	81.49	81.49	81.07	81.07	81.48	81.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peso total mayorado	Ton	124.49	111.18	112.68	112.68	113.29	113.29	92.87	92.87	93.28	93.28	31.80	31.80	31.80	31.80	31.80	31.80	31.80

ACCION COMO VIGA

ACCION COMO LOSA

DISEÑO A FLEXION EN DOS DIRECCIONES

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A_{sx}	cm²	31.36	53.38	55.34	55.34	54.27	54.27	46.89	46.89	47.30	47.30	24.48	24.48	24.48	24.48	24.48	24.48	24.48
Longitud de varilla	cm	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00
DIRECCION Y																		
A_{sy}	cm²	31.36	53.38	55.34	55.34	54.27	54.27	46.89	46.89	47.30	47.30	24.48	24.48	24.48	24.48	24.48	24.48	24.48
Longitud de varilla	cm	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	55.34
A_{sy} Máximo	cm²	55.34
EN SENTIDO X USAR	-	20 VARILLAS No. 6 L = 3.1 m. @ 16.32 cm.
EN SENTIDO Y USAR	-	20 VARILLAS No. 6 L = 3.1 m. @ 16.32 cm.

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE C

ZAPATA CONCENTRICA No. Z-7

INFORMACION GENERAL

Peso unitario del concreto (γ_c) =	2.40	Ton/m³	β =	2.00	-
Peso unitario del suelo (γ_s) =	1.80	Ton/m³	[illegible] =	15.52	Kg/cm²
Capacidad admisible del suelo (q_{adm}) =	12.00	Ton/m³	[illegible] =	20.00	-
Profundidad de desplante (D) =	1.50	m.	d =	42.50	cm.
Area columna (A_c) =	0.24	m²	[illegible] =	370.00	cm.
[illegible] (Sentido X) =	40.00	cm.	[illegible] =	14.29	Kg/cm²
[illegible] (Sentido Y) =	60.00	cm.	[illegible] =	13.55	Kg/cm²
[illegible] =	1.50	-			
f_y =	4,200.00	Kg/cm²	[illegible] (como losa) =	13.55	Kg/cm²
f'_c =	210.00	Kg/cm²	[illegible] (como viga) =	6.52	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DISEÑO ZAPATA - CARGAS MAYORADAS

ACCION COMO VIGA

ACCION COMO LOSA

DISEÑO A FLEXION EN DOS DIRECCIONES

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	57.44
A_{sy} Máximo	cm²	57.44
EN SENTIDO X USAR	-	21 VARILLAS No. 6 L = 3.1 m. @ 15.5 cm.
EN SENTIDO Y USAR	-	21 VARILLAS No. 6 L = 3.1 m. @ 15.5 cm.

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE C

ZAPATA CONCENTRICA No. B-6

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	=	2.40	Ton/m³	α =	0.85	-
Peso unitario del suelo (γ_s)	=	1.80	Ton/m³	$\phi v_c = \phi*0.27*(2+4/\beta_c)*f'_c{}^{0.5}$ =	15.52	Kg/cm²
Capacidad admisible del suelo (q_{adm})	=	12.00	Ton/m²	α_s =	20.00	-
Profundidad de desplante (Df)	=	1.50	m.	d =	53.00	cm.
Area columnas (A_c)	=	0.24	m²	b_o =	410.00	cm.
$b_{columna}$ (Sentido X)	=	40.00	cm	$\phi v_c = \phi*0.27*(2+\alpha_s*d/b_o)*f'_c{}^{0.5}$ =	15.17	Kg/cm²
$h_{columna}$ (Sentido Y)	=	60.00	cm	$\phi v_c = \phi*1.1*f'_c{}^{0.5}$ =	13.55	Kg/cm²
β_c	=	1.50	-			
f_y	=	4,200.00	Kg/cm²	ϕv_c (como losa) =	13.55	Kg/cm²
f'_c	=	210.00	Kg/cm²	$\phi v_c = \phi*0.53*f'_c{}^{0.5}$ (como viga) =	6.53	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	COMBINACIONES DE CARGA																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Ancho zapata en el sentido X (B_x)	m.	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
Largo zapata en el sentido Y (L_y)	m.	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
Relac. L / B	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d_b columna	cm.	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
d_b zapata	cm.	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
l_d	cm.	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
H zapata req.	m.	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57
H_z	m.	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**
d zapata = (H_z - 0.075)	m.	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53
Area zapata (A)	m²	12.25	12.25	12.25	12.25	12.25	12.25	12.25	12.25	12.25	12.25	12.25	12.25	12.25	12.25	12.25	12.25	12.25
Peso zapata (W_z = $A*H_z*\gamma_c$)	Ton	17.64	17.64	17.64	17.64	17.64	17.64	17.64	17.64	17.64	17.64	17.64	17.64	17.64	17.64	17.64	17.64	17.64
Peso suelo (W_s = $\gamma_s*(A-A_c)*(Df-H_z)$)	Ton	19.46	19.46	19.46	19.46	19.46	19.46	19.46	19.46	19.46	19.46	19.46	19.46	19.46	19.46	19.46	19.46	19.46
Fz	Ton	76.93	90.39	87.22	76.57	80.06	80.06	80.95	80.95	89.40	89.40	90.07	90.07	49.29	49.29	50.19	50.19	0.00
Peso total (Wt = Fz+Ws+Wz)	Ton	114.03	127.49	124.12	113.67	117.16	117.16	118.04	118.04	126.50	126.50	127.17	127.17	86.39	86.39	87.27	87.27	37.10
Mx	Ton-m	-7.69	-7.79	-7.78	-8.17	-0.60	-0.60	8.84	8.84	-2.52	-2.52	3.24	3.24	2.27	2.27	6.91	6.91	0.00
Fy	Ton	1.90	0.87	1.14	2.30	4.16	4.16	8.64	8.64	2.63	2.63	4.70	4.70	3.39	3.39	5.67	5.67	0.00
My	Ton-m	-1.01	-1.01	-1.14	-1.60	13.06	13.06	8.17	8.17	9.90	9.90	6.21	6.21	13.66	13.66	8.76	8.76	0.00
Fx	Ton	-1.66	-1.45	-1.50	-1.76	4.16	4.16	2.16	2.16	2.60	2.60	1.40	1.40	4.65	4.65	2.82	2.82	0.00
M'x = Mx+Fy*H_z	Ton-m	8.64	8.30	8.44	10.58	3.29	3.29	2.85	2.85	4.22	4.22	0.42	0.42	0.24	0.24	6.39	6.39	0.00
M'y = My+Fx*H_z	Ton-m	3.51	1.88	2.04	3.96	15.56	15.56	9.47	9.47	11.66	11.66	7.05	7.05	18.57	18.57	10.47	10.47	0.00
e_x = M'y/Wt	m.	0.03	0.01	0.02	0.03	0.13	0.13	0.08	0.08	0.09	0.09	0.06	0.06	0.19	0.19	0.12	0.12	0.00
e_y = M'x/Wt	m.	0.08	0.07	0.07	0.09	0.03	0.03	0.02	0.02	0.03	0.03	0.00	0.00	0.00	0.00	0.07	0.07	0.00
$6e_x/B_x$	-	0.04	0.03	0.03	0.04	0.23	0.23	0.14	0.14	0.16	0.16	0.10	0.10	0.33	0.33	0.21	0.21	0.00
$6e_y/L_y$	-	0.13	0.11	0.12	0.15	0.05	0.05	0.04	0.04	0.06	0.06	0.01	0.01	0.00	0.00	0.13	0.13	0.00
q_{max} = (Wt/(B_x*L_y))*(1+$6e_x/B_x$+$6e_y/L_y$)	Ton/m²	**10.80**	**11.02**	**11.60**	**11.16**	**12.20**	**12.20**	**11.38**	**11.38**	**12.88**	**12.88**	**11.42**	**11.42**	**9.40**	**9.40**	**9.48**	**9.48**	**3.03**
q_{min} = (Wt/(B_x*L_y))*(1-$6e_x/B_x$-$6e_y/L_y$)	Ton/m²	**7.73**	**8.90**	**8.67**	**7.40**	**6.92**	**6.92**	**7.91**	**7.91**	**8.10**	**8.10**	**9.34**	**9.34**	**4.75**	**4.75**	**4.76**	**4.76**	**3.03**
CHEQUEO CAPACIDAD ADMISIBLE	-	O.K.																

DISEÑO ZAPATA - CARGAS MAYORADAS

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Fz_u	Ton	107.75	113.85	110.35	110.26	111.52	111.52	73.71	73.71	74.98	74.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peso total mayorado (W_u = Fz_u+W_{zu}+W_{su})	Ton	159.63	150.61	149.21	149.21	150.47	150.47	112.66	112.66	113.93	113.93	38.95	38.95	38.95	38.95	38.95	38.95	38.95
Mx_u	Ton-m	-10.75	-8.38	0.52	0.52	11.42	11.42	2.82	2.82	13.83	13.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fy_u	Ton	2.70	0.82	4.45	4.45	7.98	7.98	4.92	4.92	6.46	6.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My_u	Ton-m	-2.12	-1.02	19.50	19.50	12.52	12.52	19.45	19.45	12.47	12.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fx_u	Ton	-2.22	-1.85	6.57	6.57	2.88	2.88	8.85	8.85	3.96	3.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'x_u$ = Mx_u+Fy_u*H_z	Ton-m	12.37	9.75	3.19	3.19	18.21	18.21	5.87	5.87	18.60	18.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$M'y_u$ = My_u+Fx_u*H_z	Ton-m	3.82	2.01	23.44	23.44	14.73	14.73	23.58	23.58	14.85	14.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{xu} = $M'y_u$/W_u	m.	0.02	0.01	0.16	0.16	0.10	0.10	0.21	0.21	0.13	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{yu} = $M'x_u$/W_u	m.	0.08	0.06	0.02	0.02	0.12	0.12	0.05	0.05	0.17	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{xu}/B_x$	-	0.04	0.02	0.27	0.27	0.17	0.17	0.36	0.36	0.22	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{yu}/L_y$	-	0.13	0.11	0.04	0.04	0.18	0.18	0.09	0.09	0.28	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00
q_{umax} = (W_u/(B_x*L_y))*(1+$6e_{xu}/B_x$+$6e_{yu}/L_y$)	Ton/m²	15.26	14.12	15.91	15.91	16.81	16.81	13.32	13.32	14.02	14.02	3.18	3.18	3.18	3.18	3.18	3.18	3.18
q_{umin} = (W_u/(B_x*L_y))*(1-$6e_{xu}/B_x$-$6e_{yu}/L_y$)	Ton/m²	10.81	10.83	8.46	8.46	7.95	7.95	5.08	5.08	4.58	4.58	3.18	3.18	3.18	3.18	3.18	3.18	3.18

ACCION COMO VIGA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
V_u	Ton	54.72	50.65	57.08	57.08	59.80	59.80	47.77	47.77	50.31	50.31	11.41	11.41	11.41	11.41	11.41	11.41	11.41
v_u	Kg/cm²	2.96	2.75	3.11	3.11	3.24	3.24	2.60	2.60	2.74	2.74	0.62	0.62	0.62	0.62	0.62	0.62	0.62
$v_u \le \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN X - v_{umax}	Kg/cm²	3.24																
DIRECCION Y																		
V_u	Ton	49.39	45.71	51.49	51.49	53.78	53.78	43.11	43.11	45.40	45.40	10.29	10.29	10.29	10.29	10.29	10.29	10.29
v_u	Kg/cm²	2.69	2.49	2.80	2.80	2.93	2.93	2.35	2.35	2.47	2.47	0.56	0.56	0.56	0.56	0.56	0.56	0.56
$v_u \le \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN Y - v_{umax}	Kg/cm²	2.93																

ACCION COMO LOSA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
b_o	cm.	410.00	410.00	410.00	410.00	410.00	410.00	410.00	410.00	410.00	410.00	410.00	410.00	410.00	410.00	410.00	410.00	410.00
V_u	Ton	171.00	158.27	178.34	178.34	186.22	186.22	149.27	149.27	157.20	157.20	35.64	35.64	35.64	35.64	35.64	35.64	35.64
v_u = V_u/b_o*d	Kg/cm²	7.94	7.35	8.28	8.28	8.65	8.65	6.93	6.93	7.30	7.30	1.66	1.66	1.66	1.66	1.66	1.66	1.66
$v_u \le \phi v_c$	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO LOSA - v_{umax}	Kg/cm²	8.65																

DISEÑO A FLEXION EN DOS DIRECCIONES

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
M_u	Ton-cm	9,415.70	11,272.39	12,374.64	12,374.64	12,959.52	12,959.52	11,187.39	11,187.39	11,792.27	11,792.27	2,673.71	2,673.71	2,673.71	2,673.71	2,673.71	2,673.71	2,673.71
K_u = $M_u/(b*d^2)$	Ton/m²	0.00960	0.01201	0.01368	0.01368	0.01440	0.01440	0.01161	0.01161	0.01222	0.01222	0.00277	0.00277	0.00277	0.00277	0.00277	0.00277	0.00277
ρ ≥ 0.0018	-	0.00265	0.00346	0.00385	0.00385	0.00403	0.00403	0.00322	0.00322	0.00338	0.00338	0.00074	0.00074	0.00074	0.00074	0.00074	0.00074	0.00074
A_{sx} = $\rho*b*d$	cm²	33.12	62.51	70.81	70.81	74.12	74.12	58.81	58.81	62.07	62.07	33.08	33.08	33.08	33.08	33.08	33.08	33.08
Longitud de varilla = Bx - 10	cm.	340.00	340.00	340.00	340.00	340.00	340.00	340.00	340.00	340.00	340.00	340.00	340.00	340.00	340.00	340.00	340.00	340.00
DIRECCION Y																		
M_u	Ton-cm	11,226.64	10,389.09	11,704.56	11,704.56	12,225.14	12,225.14	9,799.17	9,799.17	10,318.77	10,318.77	2,339.04	2,339.04	2,339.04	2,339.04	2,339.04	2,339.04	2,339.04
K_u = $M_u/(b*d^2)$	Ton/m²	0.01164	0.01077	0.01213	0.01213	0.01267	0.01267	0.01016	0.01016	0.01070	0.01070	0.00243	0.00243	0.00243	0.00243	0.00243	0.00243	0.00243
ρ ≥ 0.0018	-	0.00345	0.00312	0.00355	0.00355	0.00371	0.00371	0.00295	0.00295	0.00311	0.00311	0.00068	0.00068	0.00068	0.00068	0.00068	0.00068	0.00068
A_{sy} = $\rho*b*d$	cm²	33.12	62.51	70.81	70.81	74.12	74.12	58.81	58.81	62.07	62.07	33.08	33.08	33.08	33.08	33.08	33.08	33.08
Longitud de varilla = Ly - 10	cm.	340.00	340.00	340.00	340.00	340.00	340.00	340.00	340.00	340.00	340.00	340.00	340.00	340.00	340.00	340.00	340.00	340.00

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	74.12
A_{sy} Máximo	cm²	74.12
EN SENTIDO X USAR	-	20 VARILLAS No. 7 L = 3.4 m. @ 17.89 cm.
EN SENTIDO Y USAR	-	20 VARILLAS No. 7 L = 3.4 m. @ 17.89 cm.

DISEÑO ESTRUCTURAL DE ZAPATAS CONCENTRICAS

INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMACULADA - BLOQUE C

ZAPATA CONCENTRICA No. Z-8

INFORMACION GENERAL

Peso unitario del concreto (γ_c)	= 2.40	Ton/m³	ϕ =	0.85	
Peso unitario del suelo (γ_s)	= 1.90	Ton/m³	$\phi v_c = \phi \cdot 0.27 \cdot (2+4/\beta_c) \cdot f'_c{}^{0.5}$ =	15.50	Kg/cm²
Capacidad admisible del suelo (q_{adm})	= 12.00	Ton/m²	α_s =	20.00	-
Profundidad de desplante (D)	= 1.50	m	d =	42.50	cm
Área columnas (A_c)	= 0.24	m²	b_o =	370.00	cm
b_{col} (Sentido X)	= 40.00	cm	$\phi v_c = \phi \cdot 0.27 \cdot (\alpha_s \cdot d/b_o + 2) \cdot f'_c{}^{0.5}$ =	14.29	Kg/cm²
h_{col} (Sentido Y)	= 60.00	cm	$\phi v_c = \phi \cdot 1.1 \cdot f'_c{}^{0.5}$ =	13.55	Kg/cm²
β_c	= 1.50	-			
f_y	= 4,200.00	Kg/cm²	ϕv_c (como losa) =	13.55	Kg/cm²
f'_c	= 210.00	Kg/cm²	$\phi v_c = \phi \cdot 0.53 \cdot f'_c{}^{0.5}$ (como viga) =	6.53	Kg/cm²

DIMENSIONAMIENTO DE LA ZAPATA - CARGAS DE SERVICIO

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		COMBINACIONES DE CARGA																
Ancho zapata en el sentido X (B_z)	m	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
Largo zapata en el sentido Y (L_z)	m	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
B_{max}/L_{max}	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L_v columna	cm	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
L_v zapata	cm	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59
d = ...	cm	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17
h zapata req.	m	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57
h_z	m	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**
d zapata = h_z - 0.075	m	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43
Area zapata (A)	m²	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24	10.24
Peso zapata (W_z = A·h_z·γ_c)	Ton	12.29	12.29	12.29	12.29	12.29	12.29	12.29	12.29	12.29	12.29	12.29	12.29	12.29	12.29	12.29	12.29	12.29
Peso suelo (W_s)	Ton	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00
P	Ton	49.22	51.92	58.74	49.55	53.25	53.25	51.85	51.85	61.80	61.80	60.74	60.74	33.56	33.56	32.17	32.17	0.00
Peso total (W_T = P+W_z+W_s)	Ton	79.51	82.21	89.03	79.84	83.54	83.54	82.14	82.14	92.09	92.09	91.03	91.03	63.85	63.85	62.46	62.46	30.29
Mx	Ton-m	-7.18	-7.25	-7.22	-8.32	1.04	1.04	10.45	10.45	-0.98	-0.98	8.12	8.12	3.92	3.92	13.33	13.33	0.00
Fy	Ton	1.12	-0.25	0.89	1.43	2.78	2.78	6.75	6.75	2.10	2.10	4.30	4.36	3.31	3.31	6.30	6.30	0.00
My	Ton-m	-2.03	-2.81	-2.88	-3.32	10.90	10.90	6.14	6.14	7.09	7.09	4.09	4.09	12.11	12.11	7.35	7.35	0.00
Fx	Ton	-3.02	-3.05	-3.05	-3.12	2.26	2.26	0.35	0.35	0.95	0.95	-0.49	-0.49	2.48	2.48	1.55	1.55	0.00
Mx' = Mx+Fy·h_z	Ton-m	7.74	7.13	7.28	9.05	0.84	0.84	7.08	7.08	3.03	3.03	3.94	3.94	3.38	3.38	10.16	10.16	0.00
My' = My+Fx·h_z	Ton-m	4.54	4.34	4.39	4.87	12.03	12.03	6.31	6.31	8.17	8.17	2.85	2.85	13.85	13.85	8.12	8.12	0.00
e_x = My'/W_T	m	0.06	0.05	0.05	0.06	0.14	0.14	0.08	0.08	0.09	0.09	0.04	0.04	0.22	0.22	0.13	0.13	0.00
e_y = Mx'/W_T	m	0.10	0.08	0.08	0.11	0.01	0.01	0.09	0.09	0.03	0.03	0.04	0.04	0.04	0.04	0.16	0.16	0.00
$6e_x/B_z$	-	0.11	0.09	0.09	0.11	0.27	0.27	0.14	0.14	0.17	0.17	0.08	0.08	0.41	0.41	0.24	0.24	0.00
$6e_y/L_z$	-	0.18	0.14	0.15	0.21	0.02	0.02	0.16	0.16	0.04	0.04	0.08	0.08	0.07	0.07	0.31	0.31	0.00
q_{max} = (W_T/(B_z·L_z))·(1+$6e_x/B_z$+$6e_y/L_z$)	Ton/m²	**10.01**	**11.10**	**10.03**	**12.33**	**10.81**	**10.81**	**10.47**	**10.47**	**13.05**	**13.05**	**10.33**	**10.33**	**8.15**	**8.15**	**9.48**	**9.48**	**2.96**
q_{min} = (W_T/(B_z·L_z))·(1-$6e_x/B_z$-$6e_y/L_z$)	Ton/m²	**5.52**	**5.91**	**5.88**	**5.25**	**5.90**	**5.90**	**5.57**	**5.57**	**7.12**	**7.12**	**7.46**	**7.46**	**3.29**	**3.29**	**2.75**	**2.75**	**2.96**
CHEQUEO CAPACIDAD ADMISIBLE	-	O.K.																

DISEÑO ZAPATA - CARGAS MAYORADAS

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
P_u	Ton	88.80	79.38	77.52	77.52	75.53	75.53	50.06	50.06	49.08	49.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peso total mayorado (W_{Tu} = P_u+W_{zu}+W_{su})	Ton	111.31	111.19	109.33	109.33	107.33	107.33	81.86	81.86	79.96	79.96	31.80	31.80	31.80	31.80	31.80	31.80	31.80
Mx_u	Ton-m	-10.05	-8.73	3.06	3.06	16.50	16.50	5.29	5.29	18.73	18.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fy_u	Ton	1.57	-0.85	3.70	3.70	8.02	8.02	4.78	4.78	9.05	9.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My_u	Ton-m	-4.24	-3.28	15.49	15.49	9.66	9.66	17.19	17.19	10.37	10.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fx_u	Ton	-4.22	-3.88	3.86	3.86	1.15	1.15	4.82	4.82	2.09	2.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mx'_u = Mx_u+Fy_u·h_z	Ton-m	10.84	9.16	4.94	4.94	20.51	20.51	7.68	7.68	23.28	23.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My'_u = My_u+Fx_u·h_z	Ton-m	6.36	5.12	18.43	18.43	10.26	10.26	19.58	19.58	11.41	11.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{xu} = My'_u/W_{Tu}	m	0.06	0.05	0.17	0.17	0.10	0.10	0.24	0.24	0.14	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e_{yu} = Mx'_u/W_{Tu}	m	0.10	0.08	0.05	0.05	0.19	0.19	0.09	0.09	0.29	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{xu}/B_z$	-	0.11	0.09	0.32	0.32	0.18	0.18	0.45	0.45	0.27	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$6e_{yu}/L_z$	-	0.18	0.15	0.08	0.08	0.36	0.36	0.16	0.16	0.55	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$q_{max,u}$ = (W_{Tu}/(B_z·L_z))·(1+$6e_{xu}/B_z$+$6e_{yu}/L_z$)	Ton/m²	14.02	13.47	14.95	14.95	16.11	16.11	12.99	12.99	14.16	14.16	3.11	3.11	3.11	3.11	3.11	3.11	3.11
$q_{min,u}$ = (W_{Tu}/(B_z·L_z))·(1-$6e_{xu}/B_z$-$6e_{yu}/L_z$)	Ton/m²	7.72	8.24	6.40	6.40	4.85	4.85	3.00	3.00	1.45	1.45	3.11	3.11	3.11	3.11	3.11	3.11	3.11

ACCION COMO VIGA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
V_u = $q_{max,u}$·L_z·((B_z-b)/2-d)	Ton	43.74	42.03	46.66	46.66	50.28	50.28	40.52	40.52	44.14	44.14	9.59	9.59	9.59	9.59	9.59	9.59	9.59
v_u = V_u/(L_z·d)	Kg/cm²	3.22	3.09	3.43	3.43	3.70	3.70	2.98	2.98	3.25	3.25	0.71	0.71	0.71	0.71	0.71	0.71	0.71
v_u < ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN X - v_{umax}	Kg/cm²	3.70																
DIRECCION Y																		
V_u = $q_{max,u}$·B_z·((L_z-h)/2-d)	Ton	39.25	37.72	41.87	41.87	45.13	45.13	36.36	36.36	39.61	39.61	8.70	8.70	8.70	8.70	8.70	8.70	8.70
v_u = V_u/(B_z·d)	Kg/cm²	2.89	2.77	3.08	3.08	3.32	3.32	2.67	2.67	2.91	2.91	0.64	0.64	0.64	0.64	0.64	0.64	0.64
v_u < ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO VIGA EN Y - v_{umax}	Kg/cm²	3.32																

ACCION COMO LOSA

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
b_o	cm	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00	370.00
V_u = $q_{max,u}$·(A-(b+d)·(h+d))	Ton	131.09	128.98	140.49	140.49	151.39	151.39	122.00	122.00	132.90	132.90	28.18	28.18	28.18	28.18	28.18	28.18	28.18
v_u = V_u/(b_o·d)	Kg/cm²	8.37	8.05	8.93	8.93	9.63	9.63	7.76	7.76	8.45	8.45	1.86	1.86	1.86	1.86	1.86	1.86	1.86
v_u < ϕv_c	Kg/cm²	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
CHEQUEO ACCION COMO LOSA - v_{umax}	Kg/cm²	9.63																

DISEÑO A FLEXION EN DOS DIRECCIONES

DESCRIPCION	UNIDADES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIRECCION X																		
M_u = $q_{max,u}$·L_z·((B_z-b)/2)²/2	Ton-cm	**4,295.11**	**5,449.86**	**8,376.29**	**8,376.29**	**10,107.19**	**10,107.19**	**8,144.80**	**8,144.80**	**8,072.89**	**8,072.89**	**1,947.90**	**1,947.90**	**1,947.90**	**1,947.90**	**1,947.90**	**1,947.90**	**1,947.90**
K = M_u/(L_z·d²)	Ton/cm²	0.00781	0.01483	0.01523	0.01523	0.01749	0.01749	0.01409	0.01409	0.01535	0.01535	0.00337	0.00337	0.00337	0.00337	0.00337	0.00337	0.00337
ρ = (0.85·f'c/fy)·(1-(1-(2·K/(0.85·f'c)))^0.5) > 0.0018	-	0.00207	0.00407	0.00450	0.00450	0.00490	0.00490	0.00392	0.00392	0.00429	0.00429	0.00090	0.00090	0.00090	0.00090	0.00090	0.00090	0.00090
A_{sx} = ρ·L_z·d	cm²	28.13	55.41	61.87	61.87	66.96	66.96	53.31	53.31	58.34	58.34	24.48	24.48	24.48	24.48	24.48	24.48	24.48
Longitud de varilla = B_z - 10	cm	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00
DIRECCION Y																		
M_u = $q_{max,u}$·B_z·((L_z-h)/2)²/2	Ton-cm	**7,681.34**	**7,299.84**	**8,087.24**	**8,087.24**	**8,714.07**	**8,714.07**	**7,022.91**	**7,022.91**	**7,650.43**	**7,650.43**	**1,676.58**	**1,676.58**	**1,676.58**	**1,676.58**	**1,676.58**	**1,676.58**	**1,676.58**
K = M_u/(B_z·d²)	Ton/cm²	0.01310	0.01262	0.01398	0.01398	0.01506	0.01506	0.01215	0.01215	0.01324	0.01324	0.00291	0.00291	0.00291	0.00291	0.00291	0.00291	0.00291
ρ = (0.85·f'c/fy)·(1-(1-(2·K/(0.85·f'c)))^0.5) > 0.0018	-	0.00365	0.00359	0.00412	0.00412	0.00446	0.00446	0.00355	0.00355	0.00389	0.00389	0.00082	0.00082	0.00082	0.00082	0.00082	0.00082	0.00082
A_{sy} = ρ·B_z·d	cm²	28.13	55.41	61.87	61.87	66.96	66.96	53.31	53.31	58.34	58.34	24.48	24.48	24.48	24.48	24.48	24.48	24.48
Longitud de varilla = L_z - 10	cm	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00

REFUERZO REQUERIDO

A_{sx} Máximo	cm²	**66.96**
A_{sy} Máximo	cm²	**66.96**
EN SENTIDO X USAR	-	**24 VARILLAS No. 6 L = 3.1 m. @ 13.40 cm.**
EN SENTIDO Y USAR	-	**24 VARILLAS No. 6 L = 3.1 m. @ 13.40 cm.**

7.4 DISEÑO DE VIGAS Y COLUMNAS

7.4.1 VIGAS

V-118/N+3.45

B=0.40 H=0.45 L=7.40			B=0.40 H=0.45 L=7.50			B=0.40 H=0.45 L=7.40		
Mu=-200.35 As =15.52 As(r)=15.07		Mu=-215.59 As =17.90 As(r)=16.40	Mu=-202.93 As =17.90 As(r)=15.29		Mu=-204.30 As =16.31 As(r)=15.41	Mu=-206.92 As =16.31 As(r)=15.64		Mu=-203.42 As =15.52 As(r)=15.34
	Mu=143.32 As =11.40 As(r)=10.37			Mu=138.15 As =11.40 As(r)=9.97			Mu=141.50 As =11.40 As(r)=10.23	
Vu=-127.01	Vu=-44.49	Vu=133.72	Vu=-129.28	Vu=-44.52	Vu=129.47	Vu=-130.36	Vu=-46.60	Vu=127.67

B=0.40 H=0.45 L=4.70		
Mu=-152.94 As =15.52 As(r)=11.14		Mu=-134.72 As =11.40 As(r)=9.70
	Mu=73.55 As =11.40 As(r)=5.23	
Vu=-104.17	Vu=-59.92	Vu=93.87

V-119/N+3.45

B=0.40 H=0.45 L=3.55			B=0.40 H=0.45 L=3.55			B=0.40 H=0.45 L=3.55		
Mu=-52.05 As =8.48 As(r)=5.23		Mu=-25.29 As =8.48 As(r)=5.23	Mu=-33.76 As =8.48 As(r)=5.23		Mu=-135.05 As =9.66 As(r)=9.72	Mu=-131.85 As =9.66 As(r)=9.47		Mu=-32.96 As =9.66 As(r)=5.23
	Mu=77.00 As =5.94 As(r)=6.25			Mu=33.76 As =6.24 As(r)=5.23			Mu=32.96 As =8.61 As(r)=5.23	
Vu=-79.71	Vu=-37.71	Vu=5.32	Vu=15.11	Vu=57.11	Vu=99.11	Vu=-90.04	Vu=-48.04	Vu=-6.04

B=0.40 H=0.45 L=3.55			B=0.40 H=0.45 L=3.55			B=0.40 H=0.45 L=3.55		
Mu=-31.56 As =9.66 As(r)=5.23		Mu=-126.23 As =9.66 As(r)=9.04	Mu=-126.36 As =9.66 As(r)=9.05		Mu=-31.59 As =9.66 As(r)=5.23	Mu=-23.86 As =9.66 As(r)=5.23		Mu=-95.44 As =9.66 As(r)=6.71
	Mu=31.56 As =9.90 As(r)=5.23			Mu=31.59 As =8.96 As(r)=5.23			Mu=43.28 As =7.92 As(r)=5.23	
Vu=4.79	Vu=46.79	Vu=88.80	Vu=-92.46	Vu=-50.46	Vu=-8.46	Vu=2.50	Vu=44.23	Vu=86.23

B=0.40 H=0.45 L=2.25			B=0.40 H=0.45 L=2.25		
Mu=-66.55 As =9.66 As(r)=5.23		Mu=-16.64 As =9.66 As(r)=5.23	Mu=-6.40 As =9.66 As(r)=5.23		Mu=-25.58 As =9.66 As(r)=5.23
	Mu=16.64 As =9.90 As(r)=5.23			Mu=19.78 As =9.90 As(r)=5.23	
Vu=-45.66	Vu=-24.12	Vu=-4.35	Vu=-13.57	Vu=11.53	Vu=33.07

V-120/N+3.45

B=0.40 H=0.45 L=7.50	B=0.40 H=0.45 L=7.50	B=0.40 H=0.45 L=7.40
Mu=-255.02 As =20.28 As(r)=20.01 — Mu=-340.62 As =29.04 As(r)=29.03	Mu=-321.94 As =29.04 As(r)=27.87 — Mu=-313.59 As =29.04 As(r)=27.35	Mu=-321.96 As =29.04 As(r)=27.87 — Mu=-313.94 As =29.04 As(r)=27.37
Mu=235.86 As =17.90 As(r)=18.22	Mu=222.43 As =17.90 As(r)=17.01	Mu=229.48 As =17.90 As(r)=17.64
Vu=-185.64 Vu=-62.23 Vu=210.52	Vu=-199.90 Vu=-75.73 Vu=197.64	Vu=-201.69 Vu=-77.89 Vu=200.40

B=0.40 H=0.45 L=4.70
Mu=-291.27 As =29.04 As(r)=23.59 — Mu=-238.35 As =20.28 As(r)=18.45
Mu=185.38 As =17.90 As(r)=13.80
Vu=-208.86 Vu=-147.21 Vu=182.68

V-121/N+3.45

B=0.20 H=0.45 L=7.50	B=0.20 H=0.45 L=7.50	B=0.20 H=0.45 L=7.50
Mu=-28.05 As =3.96 As(r)=2.61 — Mu=-66.98 As =5.70 As(r)=4.82	Mu=-63.83 As =5.70 As(r)=4.58 — Mu=-59.87 As =5.70 As(r)=4.27	Mu=-62.78 As =5.70 As(r)=4.49 — Mu=-51.39 As =3.96 As(r)=3.63
Mu=38.05 As =3.96 As(r)=3.05	Mu=21.38 As =3.96 As(r)=2.61	Mu=22.04 As =3.96 As(r)=2.61
Vu=-39.75 Vu=10.48 Vu=50.26	Vu=-45.79 Vu=4.74 Vu=44.80	Vu=-45.93 Vu=4.80 Vu=40.97

B=0.30 H=0.45 L=4.90
Mu=-72.78 As =5.94 As(r)=5.12 — Mu=-43.93 As =5.94 As(r)=3.92
Mu=54.69 As =3.96 As(r)=4.50
Vu=-121.83 Vu=37.88 Vu=110.33

V-122/N+3.45

B=0.40 H=0.45 L=1.80	B=0.40 H=0.45 L=8.04
Mu=-0.00 As =20.28 As(r)=5.23 — Mu=-113.51 As =20.28 As(r)=8.07	Mu=-254.58 As =20.28 As(r)=19.97 — Mu=-213.18 As =17.90 As(r)=16.19
Mu=0.00 As =7.92 As(r)=5.23	Mu=163.01 As =11.15 As(r)=11.95
Vu=39.75 Vu=53.61 Vu=67.46	Vu=-144.19 Vu=-49.65 Vu=131.12

V-123/N+3.45

B=0.40 H=0.45 L=1.95			B=0.40 H=0.45 L=8.14		
Mu=-12.60 As =9.66 As(r)=5.23		Mu=-77.69 As =9.66 As(r)=5.41	Mu=-115.78 As =9.66 As(r)=8.24		Mu=-64.24 As =11.40 As(r)=5.23
	Mu=0.00 As =7.92 As(r)=5.23			Mu=104.34 As =8.22 As(r)=7.76	
Vu=-10.27	Vu=-29.58	Vu=-50.64	Vu=97.16	Vu=11.31	Vu=-87.03

V-124/N+3.45

B=0.40 H=0.45 L=1.80			B=0.40 H=0.45 L=8.04		
Mu=-0.00 As =20.28 As(r)=5.23		Mu=-241.27 As =20.28 As(r)=18.72	Mu=-384.28 As =20.28 As(r)=31.75		Mu=-292.37 As =17.90 As(r)=23.71
	Mu=0.00 As =7.92 As(r)=5.23			Mu=285.92 As =11.15 As(r)=23.05	
Vu=96.04	Vu=117.10	Vu=138.16	Vu=-203.89	Vu=-106.39	Vu=180.26

V-125/N+3.45

B=0.40 H=0.45 L=1.95			B=0.40 H=0.45 L=8.14		
Mu=-16.24 As =9.66 As(r)=5.23		Mu=-80.07 As =9.66 As(r)=5.58	Mu=-121.90 As =9.66 As(r)=8.71		Mu=-57.02 As =9.66 As(r)=5.23
	Mu=0.00 As =7.92 As(r)=5.23			Mu=103.91 As =8.22 As(r)=7.86	
Vu=-10.13	Vu=-29.01	Vu=-50.07	Vu=99.12	Vu=13.16	Vu=-85.06

V-126/N+3.45

B=0.40 H=0.45 L=1.80			B=0.40 H=0.45 L=8.04		
Mu=-0.00 As =33.42 As(r)=5.23		Mu=-231.03 As =33.42 As(r)=17.78	Mu=-378.65 As =33.42 As(r)=31.40		Mu=-283.75 As =25.20 As(r)=22.83
	Mu=0.00 As =20.28 As(r)=5.23			Mu=276.36 As =25.91 As(r)=22.09	
Vu=90.72	Vu=111.78	Vu=132.84	Vu=-200.38	Vu=-102.87	Vu=175.89

V-127/N+3.45

B=0.40 H=0.45 L=1.95			B=0.40 H=0.45 L=8.14		
Mu=-17.81 As =9.66 As(r)=5.23		Mu=-90.66 As =9.66 As(r)=6.36	Mu=-137.49 As =9.66 As(r)=9.92		Mu=-59.67 As =11.40 As(r)=5.23
	Mu=0.00 As =7.92 As(r)=5.23			Mu=100.42 As =8.22 As(r)=7.64	
Vu=-15.21	Vu=-33.26	Vu=-53.75	Vu=99.99	Vu=14.96	Vu=-84.33

V-128/N+3.45

B=0.40 H=0.45 L=1.80			B=0.40 H=0.45 L=8.04		
Mu=-0.00 As =33.42 As(r)=5.23		Mu=-362.78 As =33.42 As(r)=30.41	Mu=-356.40 As =33.42 As(r)=30.02		Mu=-245.39 As =25.20 As(r)=19.10
	Mu=0.00 As =20.28 As(r)=5.23			Mu=210.47 As =25.91 As(r)=15.95	
Vu=155.53	Vu=173.58	Vu=191.63	Vu=-171.73	Vu=-84.32	Vu=144.95

V-129/N+3.45

B=0.40 H=0.45 L=1.95			B=0.40 H=0.45 L=8.14		
Mu=-11.72 As =17.90 As(r)=5.23		Mu=-237.13 As =17.90 As(r)=18.34	Mu=-234.73 As =17.90 As(r)=18.12		Mu=-63.05 As =13.46 As(r)=5.23
	Mu=0.00 As =7.92 As(r)=5.23			Mu=80.26 As =8.22 As(r)=6.20	
Vu=-86.90	Vu=-104.95	Vu=-123.00	Vu=108.82	Vu=18.60	Vu=-73.18

V-130/N+3.45

B=0.40 H=0.45 L=1.75			B=0.40 H=0.45 L=8.04		
Mu=-1.30 As =22.82 As(r)=5.23		Mu=-269.36 As =22.82 As(r)=21.39	Mu=-274.37 As =22.82 As(r)=21.89		Mu=-166.99 As =13.46 As(r)=12.27
	Mu=0.00 As =11.40 As(r)=5.23			Mu=101.14 As =17.10 As(r)=7.14	
Vu=110.33	Vu=122.20	Vu=134.08	Vu=-122.75	Vu=-43.30	Vu=98.53

V-201/N+6.95

B=0.40 H=0.45 L=7.40			B=0.40 H=0.45 L=7.50			B=0.40 H=0.45 L=7.40		
Mu=-58.28 As =9.66 As(r)=5.23		Mu=-54.29 As =9.66 As(r)=5.23	Mu=-46.35 As =9.66 As(r)=5.23		Mu=-49.60 As =9.66 As(r)=5.23	Mu=-47.60 As =9.66 As(r)=5.23		Mu=-62.19 As =9.66 As(r)=5.23
	Mu=15.63 As =7.92 As(r)=5.23			Mu=16.61 As =7.92 As(r)=5.23			Mu=15.55 As =7.92 As(r)=5.23	
Vu=-27.63	Vu=7.46	Vu=27.94	Vu=-25.57	Vu=5.86	Vu=26.33	Vu=-25.52	Vu=8.07	Vu=28.55

B=0.40 H=0.45 L=4.70		
Mu=-87.99 As =9.66 As(r)=6.16		Mu=-95.78 As =9.66 As(r)=6.74
	Mu=42.67 As =7.92 As(r)=5.23	
Vu=-65.82	Vu=18.33	Vu=68.17

V-202/N+6.95

B=0.40 H=0.45 L=5.12		
Mu=-66.85 As =7.92 As(r)=5.23		Mu=-35.03 As =7.92 As(r)=5.23
	Mu=130.41 As =11.40 As(r)=9.36	
Vu=-113.04	Vu=-9.60	Vu=99.64

V-203/N+6.95

B=0.40 H=0.45 L=7.50			B=0.40 H=0.45 L=7.50			B=0.40 H=0.45 L=7.40		
Mu=-67.27 As =9.66 As(r)=5.23		Mu=-51.90 As =9.66 As(r)=5.23	Mu=-50.42 As =9.66 As(r)=5.23		Mu=-51.33 As =9.66 As(r)=5.23	Mu=-52.98 As =9.66 As(r)=5.23		Mu=-66.19 As =9.66 As(r)=5.23
	Mu=16.82 As =6.50 As(r)=5.23			Mu=18.25 As =6.50 As(r)=5.23			Mu=16.55 As =6.50 As(r)=5.23	
Vu=-29.53	Vu=-9.05	Vu=26.42	Vu=-26.75	Vu=6.57	Vu=26.98	Vu=-26.68	Vu=8.81	Vu=29.29

B=0.40 H=0.45 L=4.70		
Mu=-119.22 As =9.66 As(r)=8.50		Mu=-122.92 As =9.66 As(r)=8.79
	Mu=62.91 As =6.50 As(r)=5.23	
Vu=-93.53	Vu=20.07	Vu=94.26

V-204/N+6.95

B=0.15 H=0.45 L=4.90		
Mu=-24.97 As =2.54 As(r)=1.96		Mu=-27.52 As =2.54 As(r)=1.96
	Mu=33.49 As =2.54 As(r)=2.35	
Vu=-36.29	Vu=3.19	Vu=37.15

V-205/N+6.95

B=0.40 H=0.45 L=8.04		
Mu=-79.28 As =7.92 As(r)=5.52		Mu=-55.60 As =7.92 As(r)=5.23
	Mu=19.82 As =7.92 As(r)=5.23	
Vu=-33.41	Vu=-11.01	Vu=27.95

V-206/N+6.95

B=0.40 H=0.45 L=8.04		
Mu=-92.83 As =7.92 As(r)=6.52		Mu=-59.87 As =7.92 As(r)=5.23
	Mu=27.61 As =7.92 As(r)=5.23	
Vu=-38.04	Vu=-15.65	Vu=30.26

V-207/N+6.95

B=0.40 H=0.45 L=8.04		
Mu=-103.37 As =7.92 As(r)=7.30		Mu=-61.00 As =7.92 As(r)=5.23
	Mu=28.93 As =7.92 As(r)=5.23	
Vu=-40.91	Vu=-18.52	Vu=30.83

V-208/N+6.95

B=0.40 H=0.45 L=8.04		
Mu=-253.23 As =20.28 As(r)=19.84		Mu=-159.75 As =20.28 As(r)=11.69
	Mu=93.45 As =11.40 As(r)=6.56	
Vu=-118.48	Vu=-33.51	Vu=92.32

V-209/N+6.95

B=0.40 H=0.45 L=8.04		
Mu=-310.61 As =26.98 As(r)=27.17		Mu=-207.91 As =20.28 As(r)=15.73
	Mu=175.53 As =15.52 As(r)=12.98	
Vu=-150.32	Vu=-69.38	Vu=122.68

7.4.2 DISEÑO DE COLUMNAS

Columna B'-5

Nivel	H Libre	Losa	B	H	M1	M2	P	V1	V2	Cuantia	m/mr	Col/Vig Eje ppal	Col/vig Eje sec
N+6.95					69.23	67.06				12/#5 (1.0%)	0.46	1.34	2.53
	3.05	.45	.60	.40			-74.21	59.69	46.67				
					-140.03	-87.65				12/#5 (1.0%)	0.83		
N+3.45					164.72	98.82				12/#5 (1.0%)	0.86	1.56	1.54
	3.05	.45	.60	.40			-428.90	84.91	82.20				
		1.50			-132.59	-168.30				12/#5 (1.0%)	0.82		

Columna A-5

Nivel	H Libre	Losa	B	H	M1	M2	P	V1	V2	Cuantia	m/mr	Col/Vig Eje ppal	Col/vig Eje sec
N+6.95					-40.20	-57.31				12/#6 #7 (1.1%)	0.18	3.32	4.00
	3.05	.45	.60	.60			-99.69	47.48	44.66				
					128.21	103.74				12/#6 #7 (1.1%)	0.43		
N+3.45					-147.08	-141.06				12/#6 #7 (1.1%)	0.47	4.57	4.07
	3.05	.45	.60	.60			-374.59	86.80	96.61				
		1.50			129.30	192.38				12/#6 #7 (1.1%)	0.57		

Columnas A-6, A-7

Nivel	H Libre	Losa	B	H	M1	M2	P	V1	V2	Cuantia	m/mr	Col/Vig Eje ppal	Col/vig Eje sec
N+6.95					-45.90	-37.69				10/#7 #8 (1.8%)	0.19	1.22	4.31
	3.05	.45	.60	.40			-106.51	25.04	59.74				
					28.77	163.39				10/#7 #8 (1.8%)	0.42		
N+3.45					-28.87	-195.52				10/#7 #8 (1.8%)	0.43	1.66	3.88
	3.05	.45	.60	.40			-526.52	30.69	91.55				
		1.50			43.09	127.47				10/#7 #8 (1.8%)	0.31		

Columnas A-8, A-9, B'-8, B'-9

Nivel	H Libre	Losa	B	H	M1	M2	P	V1	V2	Cuantia	m/mr	Col/Vig Eje ppal	Col/vig Eje sec
N+6.95					-106.71	-76.33				12/#6 #7 (1.1%)	0.32	1.87	1.79
	3.05	.45	.60	.60			-243.56	75.15	38.99				
					157.91	7.59				12/#6 #7 (1.1%)	0.39		
N+3.45					-127.02	125.91				12/#6 #7 (1.1%)	0.41	2.90	3.23
	3.05	.45	.60	.60			-527.71	87.93	95.68				
		1.50			-245.86	-145.28				12/#6 #7 (1.1%)	0.63		

Columna B'-6

Nivel	H Libre	Losa	B	H	M1	M2	P	V1	V2	Cuantia	m/mr	Col/Vig Eje ppal	Col/vig Eje sec
N+6.95					52.10	77.71				10/#8 (2.1%)	0.24	1.50	4.80
	3.05	.45	.60	.40			-98.57	29.02	58.47				
					-17.67	-119.21				10/#8 (2.1%)	0.27		
N+3.45					36.63	95.82				10/#8 (2.1%)	0.24	1.23	2.69
	3.05	.45	.60	.40			-757.43	35.81	83.87				
		1.50			-45.33	-190.68				10/#8 (2.1%)	0.44		

Columna B'-7

Nivel	H Libre	Losa	B	H	M1	M2	P	V1	V2	Cuantia	m/mr	Col/Vig Eje ppal	Col/vig Eje sec
N+6.95					51.01	77.87				10/#8 (2.1%)	0.24	1.50	4.81
	3.05	.45	.60	.40			-103.41	28.47	62.07				
					-48.65	-111.44				10/#8 (2.1%)	0.29		
N+3.45					53.11	96.94				10/#8 (2.1%)	0.27	1.23	1.58
	3.05	.45	.60	.40			-750.15	37.56	91.64				
		1.50			-53.44	-214.37				10/#8 (2.1%)	0.49		

7.4.3 DISEÑO DE ELEMENTOS METALICOS

1 Design Data

This chapter provides design data and results.

1.1 Steel Frame Design

Table 1.1 - Steel Frame Preferences - AISC 360-10

Item	Value
Multi-Response Design	Step-by-Step
Frame Type	OMF
Seismic Design Grade	D
Importance Factor	1
Design System Rho	0
Design System Sds	1
Design System R	8
Design System Omega0	3
Design System Cd	5.5
Design Provision	LRFD
Analysis Method	Direct Analysis
Second Order Method	General 2nd Order
Stiffness Reduction Method	Tau-b Fixed
Phi (Bending)	0.9
Phi (Compression)	0.9
Phi (Tension-Yielding)	0.9
Phi (Tension-Fracture)	0.75
Phi (Shear)	0.9
Phi (Shear-Short Webbed Rolled I)	1
Phi (Torsion)	0.9
Ignore Seismic Code?	No
Ignore Special Seismic Load?	No
Doubler Plate Plug-Welded?	Yes
HSS Welding Type	ERW
Reduced HSS Thickness	No
Consider Deflection?	Yes
DL Ratio	120
SDL+LL Ratio	120
LL Ratio	360
Total Ratio	240
Total Camber Limit	240
Pattern Live Load Factor	0.75
D/C Ratio Limit	0.95

Table 1.2 - Steel Column Envelope

Label	Story	Section	Moment Interaction Check	PMM Combo	V22 Ratio	V33 Ratio	Class	Cont. Plate cm²	Dbl. Plate mm	B/C Ratio Major	B/C Ratio Minor
C55	N+8.85	PERFILC OL	0.136 = 0.001 + 0.098 + 0.036	COMDIS5	0.019	0.013	Slender	-39	-150	0	0
C16-2	N+8.85	PERFILC OL	0.096 = 0.005 + 0.027 + 0.064	COMDIS4	0.016	0.031	Slender	-39	-150	0	0
C33-1	N+8.85	PERFILC OL	0.078 = 0.004 + 0.027 + 0.047	COMDIS3	0.011	0.041	Slender	-39	-150	0	0
C60	N+8.85	PERFILC OL	0.19 = 0.003 + 0.147 + 0.041	COMDIS3	0.027	0.014	Slender	-39	-150	0	0
C30-2	N+8.85	PERFILC OL	0.099 = 0.007 + 0.012 + 0.08	COMDIS4	0.016	0.039	Slender	-39	-150	0	0
C34-2	N+8.85	PERFILC OL	0.097 = 0.016 + 0.003 + 0.077	COMDIS8	0.015	0.056	Slender				
C61	N+8.85	PERFILC OL	0.158 = 0.004 + 0.121 + 0.033	COMDIS3	0.025	0.015	Slender	-39	-150	0	0
C35-2	N+8.85	PERFILC OL	0.098 = 0.016 + 0.003 + 0.078	COMDIS8	0.015	0.059	Slender				
C62	N+8.85	PERFILC OL	0.239 = 0.025 + 0.131 + 0.083	COMDIS4	0.04	0.025	Slender	-39	-150	0	0

Label	Story	Section	Moment Interaction Check	PMM Combo	V22 Ratio	V33 Ratio	Class	Cont. Plate cm²	Dbl. Plate mm	B/C Ratio Major	B/C Ratio Minor
C32-2	N+8.85	PERFILCOL	0.23 = 0.016 + 0.01 + 0.204	COMDIS4	0.013	0.169	Slender	-39	-150	0	0
C31-2	N+8.85	PERFILCOL	0.117 = 0.007 + 0.059 + 0.051	COMDIS3	0.019	0.041	Slender	-39	-150	0	0
C36-1	N+8.85	PERFILCOL	0.233 = 0.019 + 0.013 + 0.201	COMDIS7	0.01	0.198	Slender				
C16	N+7.45	PERFILCOL	0.13 = 0.005 + 0.068 + 0.056	COMDIS3	0.017	0.032	Slender	-39	-150	0	0
C30	N+7.45	PERFILCOL	0.114 = 0.007 + 0.049 + 0.058	COMDIS3	0.019	0.041	Slender	-39	-150	0	0
C32	N+7.45	PERFILCOL	0.364 = 0.02 + 0.007 + 0.338	COMDIS10	0.014	0.169	Slender				
C33	N+7.45	PERFILCOL	0.147 = 0.004 + 0.047 + 0.096	COMDIS3	0.012	0.041	Slender	-39	-150	0	0
C34	N+7.45	PERFILCOL	0.155 = 0.006 + 0.048 + 0.102	COMDIS3	0.017	0.055	Slender	-39	-150	0	0
C35	N+7.45	PERFILCOL	0.179 = 0.006 + 0.057 + 0.117	COMDIS3	0.018	0.059	Slender	-39	-150	0	0
C36	N+7.45	PERFILCOL	0.556 = 0.02 + 0.014 + 0.522	COMDIS7	0.012	0.198	Slender				
C55	N+7.45	PERFILCOL	0.187 = 0.001 + 0.115 + 0.072	COMDIS3	0.019	0.013	Slender	-39	-150	0	0
C60	N+7.45	PERFILCOL	0.204 = 0.004 + 0.139 + 0.062	COMDIS3	0.028	0.014	Slender	-39	-150	0	0
C61	N+7.45	PERFILCOL	0.204 = 0.004 + 0.135 + 0.066	COMDIS3	0.025	0.015	Slender	-39	-150	0	0
C62	N+7.45	PERFILCOL	0.404 = 0.024 + 0.225 + 0.155	COMDIS4	0.04	0.025	Slender	-39	-150	0	0

Table 1.3 - Steel Beam Envelope

Label	Story	Section	Moment Interaction Check	PMM Combo	V22 Ratio	V33 Ratio	Class	Conn. V I-End kN	Conn. V J-End kN
B100	N+9.29	250X150X5	0.052 = 0.001 + 0.037 + 0.014	COMDIS3	0.005	0.001	Non-Compact	-3.0341	0
B101	N+9.29	250X150X5	0.046 = 1.121E-04 + 0.033 + 0.013	COMDIS3	0.004	0.001	Non-Compact	-2.0399	2.2957
B102	N+9.29	250X150X5	0.043 = 0.001 + 0.029 + 0.013	COMDIS3	0.004	0.001	Non-Compact	0	2.7918
B97	N+8.85	250X150X5	0.063 = 4.331E-04 + 0.054 + 0.009	COMDIS3	0.006	0.0004843	Non-Compact	-4.0527	4.6404
B98	N+8.85	250X150X5	0.066 = 0.001 + 0.055 + 0.009	COMDIS3	0.005	0.0004639	Non-Compact	-3.6585	4.1087
B99	N+8.85	250X150X5	0.074 = 0.002 + 0.062 + 0.009	COMDIS3	0.006	0.0004616	Non-Compact	-5.0936	4.1179
B106	N+8.85	250X150X5	0.053 = 3.642E-04 + 0.033 + 0.02	COMDIS3	0.004	0.001	Non-Compact	0	0
B107	N+8.85	250X150X5	0.052 = 1.98E-04 + 0.031 + 0.021	COMDIS3	0.004	0.001	Non-Compact	0	0
B108	N+8.85	250X150X5	0.051 = 0.001 + 0.032 + 0.019	COMDIS3	0.004	0.001	Non-Compact	0	0
B109	N+8.85	250X150X5	0.057 = 0.001 + 0.033 + 0.023	COMDIS3	0.004	0.001	Non-Compact	0	0
B110	N+8.85	250X150X5	0.054 = 2.903E-04 + 0.032 + 0.022	COMDIS3	0.004	0.001	Non-Compact	0	0
B111	N+8.85	250X150X5	0.055 = 0.001 + 0.034 + 0.02	COMDIS3	0.004	0.001	Non-Compact	0	0
B24	N+6.95	250X150X5	0.025 = 0 + 0.025 + 0	COMDIS4	0.004	0	Non-Compact	0	3.9444
B49	N+6.95	250X150X5	0.027 = 0 + 0.027 + 0	COMDIS3	0.004	0	Non-Compact	0	0
B50	N+6.95	250X150X5	0.025 = 0 + 0.025 + 0	COMDIS3	0.004	0	Non-Compact	0	0
B51	N+6.95	250X150X5	0.045 = 0 + 0.045 + 0	COMDIS3	0.004	0	Non-Compact	0	0
B54	N+6.95	250X150X5	0.025 = 0 + 0.025 + 0	COMDIS4	0.004	0	Non-Compact	0	3.2306
B55	N+6.95	250X150X5	0.022 = 0 + 0.022 + 0	COMDIS4	0.003	0	Non-Compact	0	2.9339
B103	N+6.95	250X150X5	0.026 = 0 + 0.026 + 0	COMDIS3	0.004	0	Non-Compact	0	0
B104	N+6.95	250X150X5	0.027 = 0 + 0.027 + 0	COMDIS3	0.004	0	Non-	0	0

Label	Story	Section	Moment Interaction Check	PMM Combo	V22 Ratio	V33 Ratio	Class	Conn. V I-End kN	Conn. V J-End kN
							Compact		
B105	N+6.95	250X150X5	0.032 = 0 + 0.032 + 0	COMDIS3	0.004	0	Non-Compact	0	0
B112	N+6.95	250X150X5	0.047 = 0 + 0.047 + 0	COMDIS8	0.007	0	Non-Compact	-5.2587	0
B113	N+6.95	250X150X5	0.058 = 0 + 0.058 + 0	COMDIS8	0.008	0	Non-Compact	-4.3998	0
B114	N+6.95	250X150X5	0.064 = 0 + 0.064 + 0	COMDIS8	0.009	0	Non-Compact	-4.6292	0
B115	N+6.95	250X150X5	0.184 = 0 + 0.184 + 0	COMDIS7	0.021	0	Non-Compact	-11.6725	0

Table 1.4 - Steel Brace Envelope

Label	Story	Section	Moment Interaction Check	PMM Combo	V22 Ratio	V33 Ratio	Class	Conn. P I-End kN	Conn. P J-End kN
D100	N+9.29	250X150X5	0.059 = 3.546E-04 + 0.05 + 0.008	COMDIS8	0.013	0.007	Non-Compact	-1.433	-1.1283
D112	N+9.29	250X150X5	0.106 = 0.001 + 0.099 + 0.006	COMDIS8	0.025	0.01	Non-Compact	-2.5483	-2.1236
D117	N+9.29	250X150X5	0.111 = 0.001 + 0.104 + 0.006	COMDIS8	0.026	0.01	Non-Compact	-2.7563	-2.3315
D122	N+9.29	250X150X5	0.059 = 3.232E-04 + 0.048 + 0.01	COMDIS8	0.013	0.006	Non-Compact	-1.4191	-1.1143
D96	N+8.85	250X150X5	0.145 = 0.007 + 0.081 + 0.057	COMDIS3	0.018	0.01	Non-Compact	8.6485	-11.4183
D99	N+8.85	250X150X5	0.104 = 0.007 + 0.061 + 0.037	COMDIS3	0.02	0.007	Non-Compact	11.3522	-12.1417
D113	N+8.85	250X150X5	0.163 = 0.006 + 0.103 + 0.054	COMDIS3	0.034	0.01	Non-Compact	17.7542	-11.4697
D114	N+8.85	250X150X5	0.152 = 0.005 + 0.14 + 0.007	COMDIS8	0.036	0.01	Non-Compact	23.4553	-8.1262
D118	N+8.85	250X150X5	0.169 = 0.006 + 0.105 + 0.057	COMDIS3	0.034	0.011	Non-Compact	17.574	-12.2262
D119	N+8.85	250X150X5	0.152 = 0.006 + 0.138 + 0.008	COMDIS8	0.036	0.01	Non-Compact	24.4187	-9.4471
D123	N+8.85	250X150X5	0.314 = 0.048 + 0.241 + 0.025	COMDIS4	0.03	0.009	Non-Compact	-25.918	-104.3282
D124	N+8.85	250X150X5	0.266 = 0.048 + 0.195 + 0.023	COMDIS4	0.031	0.007	Non-Compact	-17.3647	-105.3689
D95	N+7.45	250X150X5	0.047 = 0.002 + 0.019 + 0.026	COMDIS3	0.009	0.004	Non-Compact	8.4148	8.6485
D98	N+7.45	250X150X5	0.031 = 0.005 + 0.019 + 0.008	COMDIS8	0.009	0.002	Non-Compact	10.956	11.3522
D110	N+7.45	250X150X5	0.052 = 0.004 + 0.025 + 0.024	COMDIS3	0.016	0.003	Non-Compact	17.4619	17.7542
D111	N+7.45	250X150X5	0.036 = 0.01 + 0.026 + 0.001	COMDIS8	0.015	0.002	Non-Compact	22.9031	23.4553
D115	N+7.45	250X150X5	0.054 = 0.004 + 0.025 + 0.025	COMDIS3	0.017	0.003	Non-Compact	17.2818	17.574
D116	N+7.45	250X150X5	0.044 = 0.01 + 0.03 + 0.004	COMDIS8	0.016	0.002	Non-Compact	23.8665	24.4187
D120	N+7.45	250X150X5	0.074 = 0.016 + 0.036 + 0.022	COMDIS4	0.008	0.004	Non-Compact	-26.3649	-25.918
D121	N+7.45	250X150X5	0.063 = 0.008 + 0.046 + 0.01	COMDIS4	0.012	0.002	Non-Compact	-17.8116	-17.3647

Table 1.5 - Steel Frame Summary - AISC 360-10 (Part 1 of 2)

Story	Label	Unique Name	Design Type	Design Section	Status	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio
N+8.85	C55	80	Column	PERFILCOL	No Message	COMDIS9(C)	0.063	0.000452	0.011	0.051
N+8.85	C55		Column	PERFILCOL	No Message	COMDIS5(T)	0.135	0.001	0.098	0.036
N+8.85	C16-2	83	Column	PERFILCOL	No Message	COMDIS4(C)	0.096	0.005	0.027	0.064
N+8.85	C16-2		Column	PERFILCOL	No Message	COMDIS8(T)	0.049	0.001	0.017	0.031
N+8.85	C33-1	85	Column	PERFILCOL	No Message	COMDIS3(C)	0.078	0.004	0.027	0.047
N+8.85	C33-1		Column	PERFILCO	No	COMDIS11(T	0.015	0.003	0.008	0.005

Story	Label	Unique Name	Design Type	Design Section	Status	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio
				L	Message	)				
N+8.85	C60	91	Column	PERFILCOL	No Message	COMDIS3(C)	0.19	0.003	0.147	0.041
N+8.85	C60		Column	PERFILCOL	No Message	COMDIS11(T)	0.103	0.0003317	0.015	0.088
N+8.85	C30-2	94	Column	PERFILCOL	No Message	COMDIS4(C)	0.099	0.007	0.012	0.08
N+8.85	C30-2		Column	PERFILCOL	No Message	COMDIS8(T)	0.037	0.003	0.003	0.031
N+8.85	C34-2	96	Column	PERFILCOL	No Message	COMDIS8(C)	0.097	0.016	0.003	0.077
N+8.85	C34-2		Column	PERFILCOL	No Message	COMDIS10(T)	0.03	0.0002583	0.006	0.024
N+8.85	C61	102	Column	PERFILCOL	No Message	COMDIS3(C)	0.158	0.004	0.121	0.033
N+8.85	C61		Column	PERFILCOL	No Message	COMDIS11(T)	0.084	0.0001979	0.0004691	0.084
N+8.85	C35-2	105	Column	PERFILCOL	No Message	COMDIS8(C)	0.098	0.016	0.003	0.078
N+8.85	C35-2		Column	PERFILCOL	No Message	COMDIS10(T)	0.029	0.0001808	0.004	0.025
N+8.85	C62	110	Column	PERFILCOL	No Message	COMDIS4(T)	0.239	0.025	0.131	0.083
N+8.85	C32-2	143	Column	PERFILCOL	No Message	COMDIS4(C)	0.23	0.016	0.01	0.204
N+8.85	C31-2	136	Column	PERFILCOL	No Message	COMDIS3(C)	0.117	0.007	0.059	0.051
N+8.85	C31-2		Column	PERFILCOL	No Message	COMDIS8(T)	0.078	0.003	0.012	0.063
N+8.85	C36-1	141	Column	PERFILCOL	No Message	COMDIS7(C)	0.233	0.019	0.013	0.201
N+7.45	C16	81	Column	PERFILCOL	No Message	COMDIS3(C)	0.13	0.005	0.068	0.056
N+7.45	C16		Column	PERFILCOL	No Message	COMDIS8(T)	0.082	0.001	0.032	0.05
N+7.45	C30	92	Column	PERFILCOL	No Message	COMDIS3(C)	0.114	0.007	0.049	0.058
N+7.45	C30		Column	PERFILCOL	No Message	COMDIS8(T)	0.07	0.003	0.002	0.065
N+7.45	C32	142	Column	PERFILCOL	No Message	COMDIS10(C)	0.364	0.02	0.007	0.338
N+7.45	C33	78	Column	PERFILCOL	No Message	COMDIS3(C)	0.147	0.004	0.047	0.096
N+7.45	C33		Column	PERFILCOL	No Message	COMDIS11(T)	0.046	0.003	0.01	0.033
N+7.45	C34	89	Column	PERFILCOL	No Message	COMDIS3(C)	0.155	0.006	0.048	0.102
N+7.45	C34		Column	PERFILCOL	No Message	COMDIS10(T)	0.084	0.0001325	0.003	0.081
N+7.45	C35	100	Column	PERFILCOL	No Message	COMDIS3(C)	0.179	0.006	0.057	0.117
N+7.45	C35		Column	PERFILCOL	No Message	COMDIS10(T)	0.118	0	0.014	0.104
N+7.45	C36	140	Column	PERFILCOL	No Message	COMDIS7(C)	0.556	0.02	0.014	0.522
N+7.45	C55	79	Column	PERFILCOL	No Message	COMDIS8(C)	0.081	0.001	0.025	0.055
N+7.45	C55		Column	PERFILCOL	No Message	COMDIS3(T)	0.187	0.001	0.115	0.072
N+7.45	C60	90	Column	PERFILCOL	No Message	COMDIS3(C)	0.204	0.004	0.139	0.062
N+7.45	C60		Column	PERFILCOL	No Message	COMDIS11(T)	0.054	0	0.012	0.043
N+7.45	C61	101	Column	PERFILCOL	No Message	COMDIS3(C)	0.204	0.004	0.135	0.066
N+7.45	C61		Column	PERFILCOL	No Message	COMDIS11(T)	0.008	0	0.007	0.001
N+7.45	C62	109	Column	PERFILCOL	No Message	COMDIS4(T)	0.404	0.024	0.225	0.155
N+9.29	B100	120	Beam	250X150X5	No Message	COMDIS3(C)	0.052	0.001	0.037	0.014
N+9.29	B101	121	Beam	250X150X5	No Message	COMDIS3(C)	0.046	0.0001121	0.033	0.013
N+9.29	B101		Beam	250X150X5	No	COMDIS7(T)	0.031	0	0.03	0.001

Story	Label	Unique Name	Design Type	Design Section	Status	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio
					Message					
N+9.29	B102	122	Beam	250X150X5	No Message	COMDIS3(C)	0.043	0.001	0.029	0.013
N+8.85	B97	117	Beam	250X150X5	No Message	COMDIS5(C)	0.055	0.001	0.045	0.009
N+8.85	B97		Beam	250X150X5	No Message	COMDIS3(T)	0.063	0.0004331	0.054	0.009
N+8.85	B98	118	Beam	250X150X5	No Message	COMDIS3(T)	0.066	0.001	0.055	0.009
N+8.85	B99	119	Beam	250X150X5	No Message	COMDIS3(T)	0.074	0.002	0.062	0.009
N+8.85	B106	126	Beam	250X150X5	No Message	COMDIS3(C)	0.053	0.0003642	0.033	0.02
N+8.85	B106		Beam	250X150X5	No Message	COMDIS10(T)	0.028	0	0.024	0.004
N+8.85	B107	127	Beam	250X150X5	No Message	COMDIS3(T)	0.052	0.000198	0.031	0.021
N+8.85	B108	128	Beam	250X150X5	No Message	COMDIS5(C)	0.045	0.001	0.026	0.018
N+8.85	B108		Beam	250X150X5	No Message	COMDIS3(T)	0.051	0.001	0.032	0.019
N+8.85	B109	129	Beam	250X150X5	No Message	COMDIS3(T)	0.057	0.001	0.033	0.023
N+8.85	B110	130	Beam	250X150X5	No Message	COMDIS3(T)	0.054	0.0002903	0.032	0.022
N+8.85	B111	131	Beam	250X150X5	No Message	COMDIS3(T)	0.055	0.001	0.034	0.02
N+6.95	B24	47	Beam	250X150X5	No Message	COMDIS4(C)	0.025	0	0.025	0
N+6.95	B49	114	Beam	250X150X5	No Message	COMDIS3(C)	0.027	0	0.027	0
N+6.95	B50	115	Beam	250X150X5	No Message	COMDIS3(C)	0.025	0	0.025	0
N+6.95	B51	116	Beam	250X150X5	No Message	COMDIS3(C)	0.045	0	0.045	0
N+6.95	B54	48	Beam	250X150X5	No Message	COMDIS4(C)	0.025	0	0.025	0
N+6.95	B55	49	Beam	250X150X5	No Message	COMDIS4(C)	0.022	0	0.022	0
N+6.95	B103	123	Beam	250X150X5	No Message	COMDIS3(C)	0.026	0	0.026	0
N+6.95	B104	124	Beam	250X150X5	No Message	COMDIS3(C)	0.027	0	0.027	0
N+6.95	B105	125	Beam	250X150X5	No Message	COMDIS3(C)	0.032	0	0.032	0
N+6.95	B112	132	Beam	250X150X5	No Message	COMDIS8(C)	0.047	0	0.047	0
N+6.95	B113	133	Beam	250X150X5	No Message	COMDIS8(C)	0.058	0	0.058	0
N+6.95	B114	134	Beam	250X150X5	No Message	COMDIS8(C)	0.064	0	0.064	0
N+6.95	B115	135	Beam	250X150X5	No Message	COMDIS7(C)	0.184	0	0.184	0
N+9.29	D100	77	Brace	250X150X5	No Message	COMDIS8(C)	0.059	0.0003546	0.05	0.008
N+9.29	D112	88	Brace	250X150X5	No Message	COMDIS8(C)	0.106	0.001	0.099	0.006
N+9.29	D117	99	Brace	250X150X5	No Message	COMDIS8(C)	0.111	0.001	0.104	0.006
N+9.29	D122	108	Brace	250X150X5	No Message	COMDIS8(C)	0.059	0.0003232	0.048	0.01
N+8.85	D96	82	Brace	250X150X5	No Message	COMDIS3(C)	0.145	0.007	0.081	0.057
N+8.85	D96		Brace	250X150X5	No Message	COMDIS3(T)	0.057	0.002	0.023	0.032
N+8.85	D99	84	Brace	250X150X5	No Message	COMDIS3(C)	0.104	0.007	0.061	0.037
N+8.85	D99		Brace	250X150X5	No Message	COMDIS8(T)	0.038	0.005	0.03	0.004
N+8.85	D113	93	Brace	250X150X5	No Message	COMDIS3(C)	0.163	0.006	0.103	0.054
N+8.85	D113		Brace	250X150X5	No Message	COMDIS11(T)	0.069	0.008	0.061	0.001
N+8.85	D114	95	Brace	250X150X5	No	COMDIS8(C)	0.152	0.005	0.14	0.007

Story	Label	Unique Name	Design Type	Design Section	Status Message	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio
N+8.85	D114		Brace	250X150X5	No Message	COMDIS8(T)	0.076	0.01	0.063	0.003
N+8.85	D118	103	Brace	250X150X5	No Message	COMDIS3(C)	0.169	0.006	0.105	0.067
N+8.85	D118		Brace	250X150X5	No Message	COMDIS11(T)	0.072	0.008	0.062	0.003
N+8.85	D119	104	Brace	250X150X5	No Message	COMDIS8(C)	0.152	0.006	0.138	0.008
N+8.85	D119		Brace	250X150X5	No Message	COMDIS8(T)	0.075	0.01	0.06	0.005
N+8.85	D123	111	Brace	250X150X5	No Message	COMDIS4(C)	0.314	0.048	0.241	0.025
N+8.85	D123		Brace	250X150X5	No Message	COMDIS11(T)	0.038	0.0003975	0.034	0.003
N+8.85	D124	112	Brace	250X150X5	No Message	COMDIS4(C)	0.266	0.048	0.195	0.023
N+8.85	D124		Brace	250X150X5	No Message	COMDIS9(T)	0.026	0.002	0.024	0.001
N+7.45	D95	75	Brace	250X150X5	No Message	COMDIS8(C)	0.018	0.002	0.003	0.013
N+7.45	D95		Brace	250X150X5	No Message	COMDIS3(T)	0.047	0.002	0.019	0.026
N+7.45	D98	76	Brace	250X150X5	No Message	COMDIS11(C)	0.015	0.003	0.009	0.002
N+7.45	D98		Brace	250X150X5	No Message	COMDIS8(T)	0.031	0.005	0.019	0.008
N+7.45	D110	86	Brace	250X150X5	No Message	COMDIS9(C)	0.02	0.004	0.016	0.001
N+7.45	D110		Brace	250X150X5	No Message	COMDIS3(T)	0.052	0.004	0.025	0.024
N+7.45	D111	87	Brace	250X150X5	No Message	COMDIS11(C)	0.024	0.005	0.017	0.001
N+7.45	D111		Brace	250X150X5	No Message	COMDIS8(T)	0.036	0.01	0.026	0.001
N+7.45	D115	97	Brace	250X150X5	No Message	COMDIS9(C)	0.021	0.004	0.015	0.002
N+7.45	D115		Brace	250X150X5	No Message	COMDIS3(T)	0.054	0.004	0.025	0.025
N+7.45	D116	98	Brace	250X150X5	No Message	COMDIS11(C)	0.023	0.005	0.018	0.0002469
N+7.45	D116		Brace	250X150X5	No Message	COMDIS8(T)	0.044	0.01	0.03	0.004
N+7.45	D120	106	Brace	250X150X5	No Message	COMDIS4(C)	0.074	0.016	0.036	0.022
N+7.45	D120		Brace	250X150X5	No Message	COMDIS11(T)	0.027	0.0003859	0.025	0.002
N+7.45	D121	107	Brace	250X150X5	No Message	COMDIS4(C)	0.063	0.008	0.046	0.01
N+7.45	D121		Brace	250X150X5	No Message	COMDIS9(T)	0.032	0.002	0.027	0.004

Table 1.5 - Steel Frame Summary - AISC 360-10 (Part 2 of 2)

Story	Label	Unique Name	V Major Combo	V Major Ratio	V Minor Combo	V Minor Ratio
N+8.85	C55	80	COMDIS3	0.019	COMDIS4	0.013
N+8.85	C55					
N+8.85	C16-2	83	COMDIS3	0.016	COMDIS4	0.031
N+8.85	C16-2					
N+8.85	C33-1	85	COMDIS3	0.011	COMDIS8	0.041
N+8.85	C33-1					
N+8.85	C60	91	COMDIS3	0.027	COMDIS8	0.014
N+8.85	C60					
N+8.85	C30-2	94	COMDIS3	0.016	COMDIS4	0.039
N+8.85	C30-2					
N+8.85	C34-2	96	COMDIS3	0.015	COMDIS8	0.055
N+8.85	C34-2					
N+8.85	C61	102	COMDIS3	0.025	COMDIS4	0.015
N+8.85	C61					
N+8.85	C35-2	105	COMDIS3	0.015	COMDIS8	0.059

Story	Label	Unique Name	V Major Combo	V Major Ratio	V Minor Combo	V Minor Ratio
N+8.85	C35-2					
N+8.85	C62	110	COMDIS3	0.04	COMDIS4	0.025
N+8.85	C32-2	143	COMDIS3	0.013	COMDIS10	0.169
N+8.85	C31-2	136	COMDIS3	0.019	COMDIS4	0.041
N+8.85	C31-2					
N+8.85	C36-1	141	COMDIS3	0.01	COMDIS7	0.198
N+7.45	C16	81	COMDIS3	0.017	COMDIS4	0.032
N+7.45	C16					
N+7.45	C30	92	COMDIS3	0.019	COMDIS4	0.041
N+7.45	C30					
N+7.45	C32	142	COMDIS3	0.014	COMDIS10	0.169
N+7.45	C33	78	COMDIS3	0.012	COMDIS8	0.041
N+7.45	C33					
N+7.45	C34	89	COMDIS3	0.017	COMDIS8	0.055
N+7.45	C34					
N+7.45	C35	100	COMDIS3	0.018	COMDIS8	0.059
N+7.45	C35					
N+7.45	C36	140	COMDIS3	0.012	COMDIS7	0.198
N+7.45	C55	79	COMDIS3	0.019	COMDIS4	0.013
N+7.45	C55					
N+7.45	C60	90	COMDIS3	0.028	COMDIS8	0.014
N+7.45	C60					
N+7.45	C61	101	COMDIS3	0.025	COMDIS4	0.015
N+7.45	C61					
N+7.45	C62	109	COMDIS3	0.04	COMDIS4	0.025
N+9.29	B100	120	COMDIS3	0.005	COMDIS5	0.001
N+9.29	B101	121	COMDIS1	0.004	COMDIS3	0.001
N+9.29	B101					
N+9.29	B102	122	COMDIS1	0.004	COMDIS5	0.001
N+8.85	B97	117	COMDIS3	0.006	COMDIS5	0.0004843
N+8.85	B97					
N+8.85	B98	118	COMDIS3	0.005	COMDIS5	0.0004639
N+8.85	B99	119	COMDIS3	0.006	COMDIS3	0.0004616
N+8.85	B106	126	COMDIS3	0.004	COMDIS3	0.001
N+8.85	B106					
N+8.85	B107	127	COMDIS1	0.004	COMDIS3	0.001
N+8.85	B108	128	COMDIS3	0.004	COMDIS3	0.001
N+8.85	B108					
N+8.85	B109	129	COMDIS3	0.004	COMDIS3	0.001
N+8.85	B110	130	COMDIS1	0.004	COMDIS3	0.001
N+8.85	B111	131	COMDIS3	0.004	COMDIS3	0.001
N+6.95	B24	47	COMDIS4	0.004	COMDIS11	0
N+6.95	B49	114	COMDIS1	0.004	COMDIS11	0
N+6.95	B50	115	COMDIS1	0.004	COMDIS11	0
N+6.95	B51	116	COMDIS3	0.004	COMDIS11	0
N+6.95	B54	48	COMDIS4	0.004	COMDIS11	0
N+6.95	B55	49	COMDIS4	0.003	COMDIS11	0
N+6.95	B103	123	COMDIS1	0.004	COMDIS11	0
N+6.95	B104	124	COMDIS1	0.004	COMDIS11	0
N+6.95	B105	125	COMDIS1	0.004	COMDIS11	0
N+6.95	B112	132	COMDIS8	0.007	COMDIS11	0
N+6.95	B113	133	COMDIS8	0.008	COMDIS11	0
N+6.95	B114	134	COMDIS8	0.009	COMDIS11	0
N+6.95	B115	135	COMDIS7	0.021	COMDIS11	0
N+9.29	D100	77	COMDIS8	0.013	COMDIS3	0.007
N+9.29	D112	88	COMDIS8	0.025	COMDIS3	0.01
N+9.29	D117	99	COMDIS8	0.026	COMDIS3	0.01
N+9.29	D122	108	COMDIS8	0.013	COMDIS3	0.006
N+8.85	D96	82	COMDIS11	0.018	COMDIS3	0.01
N+8.85	D96					

Story	Label	Unique Name	V Major Combo	V Major Ratio	V Minor Combo	V Minor Ratio
N+8.85	D99	84	COMDIS8	0.02	COMDIS3	0.007
N+8.85	D99					
N+8.85	D113	93	COMDIS11	0.034	COMDIS3	0.01
N+8.85	D113					
N+8.85	D114	95	COMDIS8	0.036	COMDIS3	0.01
N+8.85	D114					
N+8.85	D118	103	COMDIS11	0.034	COMDIS3	0.011
N+8.85	D118					
N+8.85	D119	104	COMDIS8	0.036	COMDIS3	0.01
N+8.85	D119					
N+8.85	D123	111	COMDIS10	0.03	COMDIS3	0.009
N+8.85	D123					
N+8.85	D124	112	COMDIS8	0.031	COMDIS5	0.007
N+8.85	D124					
N+7.45	D95	75	COMDIS11	0.009	COMDIS3	0.004
N+7.45	D95					
N+7.45	D98	76	COMDIS8	0.009	COMDIS3	0.002
N+7.45	D98					
N+7.45	D110	86	COMDIS11	0.016	COMDIS3	0.003
N+7.45	D110					
N+7.45	D111	87	COMDIS8	0.015	COMDIS3	0.002
N+7.45	D111					
N+7.45	D115	97	COMDIS11	0.017	COMDIS3	0.003
N+7.45	D115					
N+7.45	D116	98	COMDIS8	0.016	COMDIS3	0.002
N+7.45	D116					
N+7.45	D120	106	COMDIS11	0.008	COMDIS3	0.004
N+7.45	D120					
N+7.45	D121	107	COMDIS8	0.012	COMDIS3	0.002
N+7.45	D121					

7.5 DISEÑO DE ELEMNTOS COMPLEMENTARIOS

7.5.1 DISEÑO DE ELEMENTOS METÁLICOS AISC360-2010

DISEÑO DE UNIONES DE ELEMENTOS METÁLICOS-CONCRETO

TER

CARGAS

P=	78,44	kN
M33=	18,68	kN.m
M22=	67,36	kN.m
V22=	10,88	kN
V33=	98,25	kN

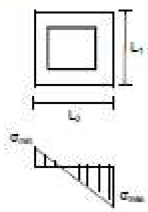
DATOS DEL PERFIL

H=	0,26	m.
B=	0,16	m.

MATERIALES

f'c=	21000	kN/m^2		
fy=	262000	kN/m^2	platina	A36
fy=	736000	kN/m^2	pernos	B-7
ex=	0,209	m		

1. DIMENSIONAMIENTO EN PLANTA DE LA PLATINA

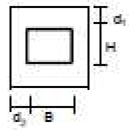


f'c >= Esfuerzo sobre la platina σ_0

		L_1(asumido)=	0,30	m.
σ_0 =	P / L^2 =	L_2(asumido)=	0,40	m.

σ_{min} =	-566,24 kN/m	OK.	σ_{red} =	289,612
σ_{max} =	1097,61 kN/m	OK.		

2. ESPESOR DE LA PLATINA

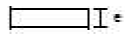


Datos del perfil:

$H =$ **0,26 m**
$B =$ **0,16 m**
$d_1 =$ 0,025 m
$d_2 =$ 0,140 m

$M_1 =$ 0,25 kN.m $V =$ 19,2 kN
$M_2 =$ 1,95 kN.m $V =$ 27,8 kN

$M_{diseño} =$ 1,95 kN.m



$e_{requerido} =$ **0,88 cm**
$e_{colocado} =$ **0,27 pulgadas**

Colocar una platina de 299x400x1/2"- Acero A36

3. DISEÑO DE PERNOS

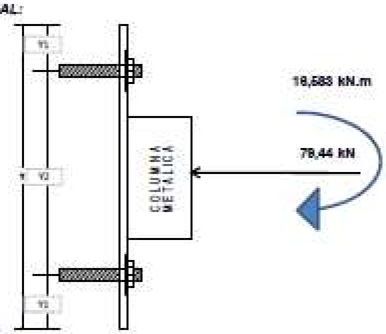
3.1. DISEÑO DE PERNOS EN SENTIDO LONGITUDINAL:

Y1= **0,040 m**

Y2= **0,220 m**

Y1= **0,040 m**

Y= **0,30 m**



Número total de anclajes: 4 Und.

CARGA POR CORTANTE:

VR = 96,88 **kN**

$V_{ANCLAJE}$ = VR / # total de anclajes = **24,22 kN**

$V_{RESISTENTE}$ = **341,33 kN**

CARGA POR COMPRESIÓN:

$P_{ANCLAJE}$ = Pu / # total de anclajes = **19,86 kN**

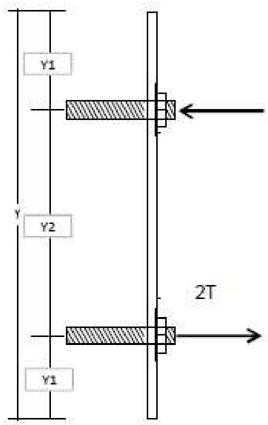
CARGA POR MOMENTO:

Y1= **0,040 m**

Y2= **0,220 m**

Y1= **0,040 m**

Y= **0,30 m**

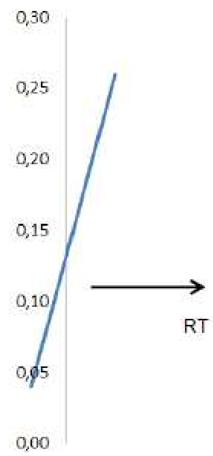


σ_{max} = 9374,23 **kN/m²**

e = 0,21 m

X= 0,13 m

σ_{min} = -6583,93 **kN/m²**



1 eje de pernos de anclaje trabajan en tensión.

RT $_{33}$ **=** 222,54 KN

222,54 = 2T

T $_{33}$ = **111,27** **kN**

As $_{33}$ **=** 1,682 cm^2 *2 Pernos de 7/8"Acero B-7* 7,74 cm^2

T $_{RESISTENTE\ 33}$ **=** **512,00 kN**

3.2. DISEÑO DE PERNOS EN SENTIDO TRANSVERSAL:

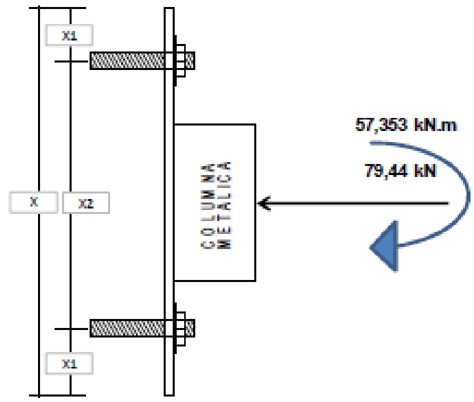
X1= 0,070 m

X2= 0,260 m

X1= 0,070 m

X= 0,40 m

Número total de anclajes: 4 Und.



CARGA POR CORTANTE:

VR = 96,88 kN

$V_{ANCLAJE}$ = VR / # total de anclajes = 24,22 kN

$V_{RESISTENTE}$ = 341,33 kN

CARGA POR COMPRESIÓN:

$P_{ANCLAJE}$ = Pu / # total de anclajes = 19,86 kN

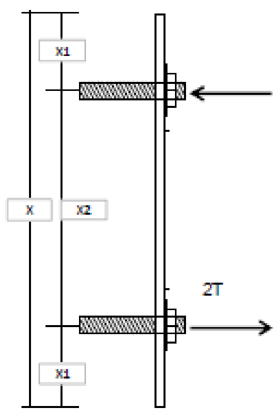
CARGA POR MOMENTO:

X1= 0,070 m

X2= 0,260 m

X1= 0,070 m

X= 0,40 m

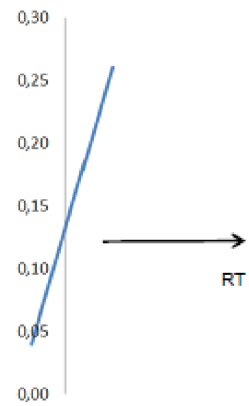


σ_{max} = 24639,46 kN/m²

e = 0,72 m

X= 0,19 m

σ_{min} = -21849,15 kN/m²



1 eje de pernos de anclaje trabajan en tensión.

RT_{22} =	899,55 KN				
	899,55	=	2T		
	T_{22}	**=**	**449,78**	**kN**	
As_{22} =	6,799 cm^2			***2 Pernos de 7/8"Acero B-7***	7,74 cm^2
$T_{RESISTENTE\ 22}$ =	**512,00 kN**				
As_{TOTAL} =	**15,48 cm^2**			***4 Pernos de 7/8"Acero B-7***	**15,48 cm^2**
$T_{RESISTENTE\ TOTAL}$ =	**1024,00 kN**				

VERIFICACIÓN EFECTOS COMBINADOS:

T ACTUANTE TOTAL = $T_{33} + T_{22}$ = **561,04 kN**

$$(T_{ACTUANTE\ TOTAL} / T_{RESISTENTE\ TOTAL})^2 + (V_{ACTUANTE} / V_{RESISTENTE})^2 \leq 1$$

0,31 **≤** **1** **OK**

DISEÑO DE UNIONES DE ELEMENTOS METÁLICOS-CONCRETO
TER

CARGAS

P=	22,59	kN
M33=	20,36	kN.m
M22=	3,13	kN.m
V22=	10,30	kN
V33=	1,93	kN

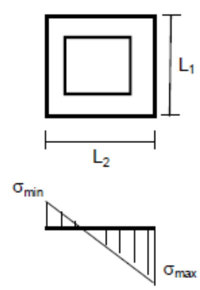
DATOS DEL PERFIL

H=	0,25	m.
B=	0,15	m.

MATERIALES

f'c=	21000	kN/m^2		
fy=	252000	kN/m^2	platina	A36
fy=	735000	kN/m^2	pernos	B-7
ex=	0,901	m		

1. DIMENSIONAMIENTO EN PLANTA DE LA PLATINA



f'c >= Esfuerzo sobre la platina σ_h

$\sigma_h = \; P / L^2 =$

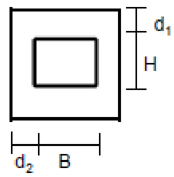
L_1(asumido)=	0,36	m.
L_2(asumido)=	0,40	m.

$\sigma_{min} =$	-785,46	kN/m	OK.
$\sigma_{max} =$	910,96	kN/m	OK.

$\sigma_{med} =$ 100,330

2. ESPESOR DE LA PLATINA

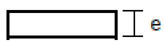
Datos del perfil:



H=	0,25 m
B=	0,15 m
d_1 =	0,055 m
d_2 =	0,140 m

M_1=	0,97 kN.m	V=	39,3 kN
M_2=	0,55 kN.m	V=	7,9 kN

$M_{diseño}$ = 0,97 kN.m



$e_{requerido}$ = **0,48 cm**

$e_{colocado}$ = **0,19 pulgadas**

Colocar una platina de 360x400x1/2"- Acero A36

3. DISEÑO DE PERNOS

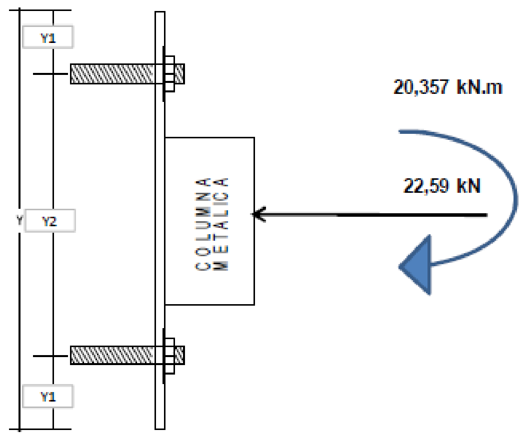
3.1. DISEÑO DE PERNOS EN SENTIDO LONGITUDINAL:

Y1= **0,070 m**

Y2= **0,220 m**

Y1= **0,070 m**

Y= **0,36 m**



Número total de anclajes: **4** Und.

CARGA POR CORTANTE:

VR = 10,48 **kN**

V $_{ANCLAJE}$ = VR / # total de anclajes = **2,62 kN**

V $_{RESISTENTE}$ = **175,52 kN**

CARGA POR COMPRESIÓN:

P $_{ANCLAJE}$ = Pu / # total de anclajes = **5,65 kN**

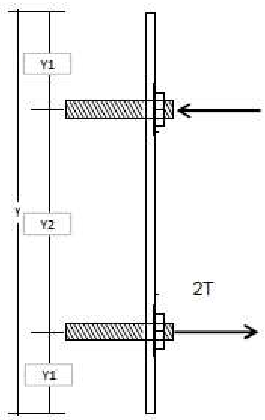
CARGA POR MOMENTO:

Y1= 0,070 m

Y2= 0,220 m

Y1= 0,070 m

Y= 0,36 m

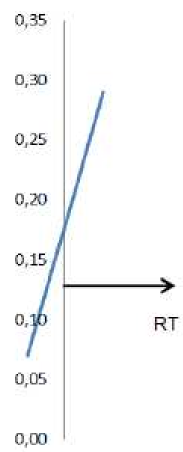


σ_{max} = **10101,06 kN/m²**

e = 0,90 m

X= 0,18 m

σ_{min} = **-9311,20 kN/m²**



1 eje de pernos de anclaje trabajan en tensión.

RT $_{33}$ **=** 435,76 KN

435,76 = 2T

T $_{33}$ = **217,88** **kN**

As $_{33}$ **=** 3,294 cm² *2 Pernos de 5/8"Acero B-7* 3,98 cm²

T $_{RESISTENTE\ 33}$ **=** **263,28 kN**

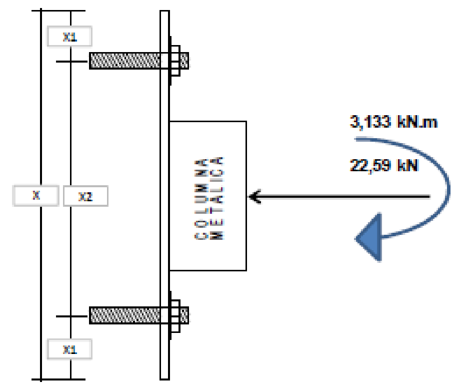
3.2. DISEÑO DE PERNOS EN SENTIDO TRANSVERSAL:

X1= 0,070 m

X2= 0,250 m

X1= 0,070 m

X= 0,39 m



Número total de anclajes: 4 Und.

CARGA POR CORTANTE:

VR = 10,48 **kN**

$V_{ANCLAJE}$ = VR / # total de anclajes = **2,62 kN**

$V_{RESISTENTE}$ = **175,52 kN**

CARGA POR COMPRESIÓN:

$P_{ANCLAJE}$ = Pu / # total de anclajes = **5,65 kN**

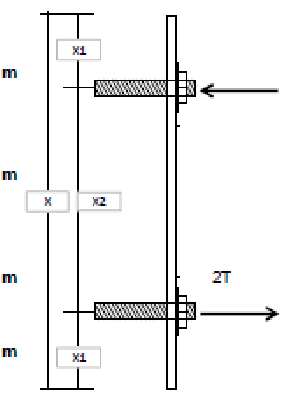
CARGA POR MOMENTO:

X1= 0,070 m

X2= 0,250 m

X1= 0,070 m

X= 0,39 m

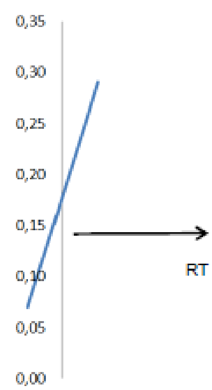


σ_{max} = **1658,92 kN/m²**

e = 0,14 m

X= 0,13 m

σ_{min} = **-869,06 kN/m²**



1 eje de pernos de anclaje trabajan en tensión.

RT_{22} =	25,63 KN				
	25,63	=	2T		
T_{22}	**=**	**12,82**	**kN**		
As_{22} =	0,194 cm^2			***2 Pernos de 5/8"Acero B-7***	3,98 cm^2
$T_{RESISTENTE\ 22}$ =	**263,28 kN**				
As_{TOTAL} =	**7,96 cm^2**			***4 Pernos de 5/8"Acero B-7***	**7,96 cm^2**
$T_{RESISTENTE\ TOTAL}$ =	**526,55 kN**				

VERIFICACIÓN EFECTOS COMBINADOS:

T ACTUANTE TOTAL = $T_{33} + T_{22}$ = **230,70 kN**

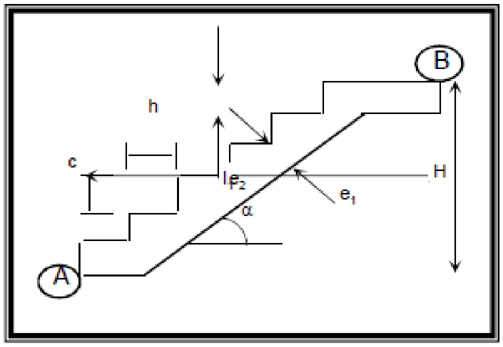
$$(T_{ACTUANTE\ TOTAL} / T_{RESISTENTE\ TOTAL})^2 + (V_{ACTUANTE} / V_{RESISTENTE})^2 \leq 1$$

0,19 **≤** **1** **OK**

7.5.2 Diseño de escalera tipo

Diseño Tramos Inclinados

El diseño se realiza para el tramo inclinado de la escalera mas largo.



Geometría de la losa

l_1 =	8,10	m	fy =	420	MPa
H =	3,50	m	f'c =	21,1	MPa
c =	17,3	cm	h =	30	cm

Espesor escogido: **20** **cm**

Pendiente α = h/l1 : 29,971 °

Cargas

Peso propio de la losa	0.2x100x24/cos30.96º	5,54	kN/m²
Peso propio de peldaños	1/2x(0.18x0.28)/0.28x24	2,08	kN/m²
Acabado peldaños	0.04x(0.18+0.28)/0.28x22	1,39	kN/m²
Afinado Inferior	0.02x22/cos30.96º	0,51	kN/m²
Sobrecarga		5,00	kN/m²
		19,41	**kN/m²**

CU = ***19,41*** **kN/m²**

Diseño Tramo Inclinado

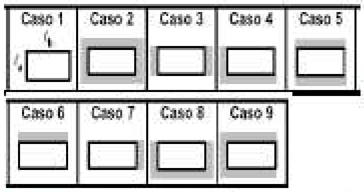
Momentos en tramo A-B. M= $\boxed{\textbf{159,23}}$ kN-m

Cuantía:	0,0162	Asmín = 2.4 cm²/m
As	32,40 cm²/m	*Colocar 1#7 c/.10 longitudinalmente*
		Colocar 1#4 c/.15 transversalmente

7.5.3 DISEÑO DE PLACA MACIZAS

DISEÑO PLACA MACIZA TANQUES

El diseño de la placa maciza se realiza de acuerdo con lo establecido en C.13.9 de las NSR - 10



Geometría de la losa

la =	3,55	m	fy =	**420**	MPa
lb =	3,87	m	f'c =	**21,1**	MPa
Relación m =	**0,92**				

Espesor escogido: 0,10 **m**

Teniendo en cuenta que la relación m es mayor de 0.5, la placa maciza trabaja en dos direcciones

Cargas

Peso propio de la losa	0.1x1.0x24	2,40	kN/m²
Muros divisorios		2,00	kN/m²
Acabados	0.05x20	1,10	kN/m²
Carga Muerta Total		5,50	kN/m²
Carga Viva		5,00	kN/m²
Carga Última		14,60	kN/m²

Tipo de soporte CASO Nº 4

DISEÑO A MOMENTO FLECTOR

Coeficientes para momento positivo por carga muerta y viva:

C_{aD} = 0,043
C_{bD} = 0,013
C_{aV} = 0,052
C_{bV} = 0,016

Mua =	**6,26**	kN.m	*Cuantía:*	0,0032	*As =*	2,21 cm²/m
Mu_b =	**2,27**	kN.m	*Cuantía:*	0,0020	*As =*	1,40 cm²/m

Coeficientes para momento negativo por carga última:

C_a =	0,076	Mu_a =	**13,98**	kN.m	*Cuantía:*	0,0074	*As =*	5,21 cm²/m
C_b =	0,024	Mu_b =	**5,25**	kN.m	*Cuantía:*	0,0026	*As =*	1,84 cm²/m

Distribución de refuerzo inferior:

Sentido La *1#4c/0.2*

Sentido Lb *1#4c/0.2*

Distribución de refuerzo superior:

Sentido La *1#4c/0.2*

Sentido Lb *1#4c/0.2*

REVISIÓN A CORTANTE

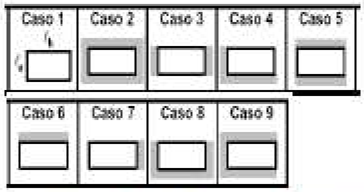
Coeficientes de relación de carga en las dos direcciones para cortante:

W_a = 0,76
W_b = 0,24

ϕvc =	**0,574**	**MPa**	
ϕvu_a =	**0,215**	**MPa**	**OK**
ϕvu_b =	**0,062**	**MPa**	**OK**

DISEÑO PLACA MACIZA ENTREPISO

El diseño de la placa maciza se realiza de acuerdo con lo establecido en C.13.9 de las NSR - 10



Geometría de la losa

la =	**3,55**	m	fy =	**420**	MPa
lb =	**3,87**	m	f'c =	**21,1**	MPa

Relación m = **0,92**

Espesor escogido: **0,10** **m**

Teniendo en cuenta que la relación m es mayor de 0.5, la placa maciza trabaja en dos direcciones

Cargas

Peso propio de la losa	0.1x1.0x24	2,40	kN/m²
Muros divisorios		2,00	kN/m²
Acabados	0.05x20	1,10	kN/m²
Carga Muerta Total		5,50	kN/m²
Carga Viva		5,00	kN/m²
Carga Última		14,60	kN/m²

Tipo de soporte CASO Nº 8

DISEÑO A MOMENTO FLECTOR

Coeficientes para momento positivo por carga muerta y viva:

C_{aD} = 0,036
C_{bD} = 0,013
C_{aV} = 0,049
C_{bV} = 0,016

Mua =	**5,58**	kN.m	*Cuantía:*	0,0028	*As =*	1,96 cm²/m
Mu_b =	**2,27**	kN.m	*Cuantía:*	0,0020	*As =*	1,40 cm²/m

Coeficientes para momento negativo por carga última:

C_a =	0,061	Mu_a =	**11,22**	kN.m	*Cuantía:*	0,0059	*As =*	4,10 cm²/m
C_b =	0,036	Mu_b =	**7,87**	kN.m	*Cuantía:*	0,0040	*As =*	2,81 cm²/m

Distribución de refuerzo inferior:

Sentido La *1#4c/0.2*

Sentido Lb *1#4c/0.2*

Distribución de refuerzo superior:

Sentido La *1#4c/0.2*

Sentido Lb *1#4c/0.2*

REVISIÓN A CORTANTE

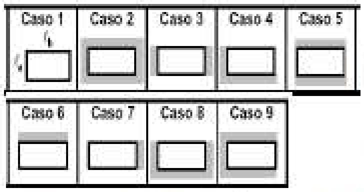
Coeficientes de relación de carga en las dos direcciones para cortante:

W_a = 0,61
W_b = 0,39

ϕvc =	**0,574**	**MPa**	
ϕvu_a =	**0,172**	**MPa**	**OK**
ϕvu_b =	**0,101**	**MPa**	**OK**

DISEÑO PLACA MACIZA ENTREPISO

El diseño de la placa maciza se realiza de acuerdo con lo establecido en C.13.9 de las NSR - 10



Geometría de la losa

la =	3,55	m	fy =	**420**	MPa
lb =	3,87	m	f'c =	**21,1**	MPa

Relación m = **0,92**

Espesor escogido: 0,10 **m**

Teniendo en cuenta que la relación m es mayor de 0.5, la placa maciza trabaja en dos direcciones

Cargas

Peso propio de la losa	0.1x1.0x24	2,40	kN/m²
Muros divisorios		2,00	kN/m²
Acabados	0.05x20	1,10	kN/m²
Carga Muerta Total		5,50	kN/m²
Carga Viva		5,00	kN/m²
Carga Última		14,60	kN/m²

Tipo de soporte CASO Nº 2

DISEÑO A MOMENTO FLECTOR

Coeficientes para momento positivo por carga muerta y viva:

C_{aD} = 0,028
C_{bD} = 0,009
C_{aV} = 0,045
C_{bV} = 0,014

Mua =	**4,78**	kN.m	*Cuantía:*	0,0024	*As =*	1,67	cm²/m
Mu_b =	**1,79**	kN.m	*Cuantía:*	0,0020	*As =*	1,40	cm²/m

Coeficientes para momento negativo por carga última:

C_a =	0,069	Mu_a =	**12,70**	kN.m	*Cuantía:*	0,0067	*As =*	4,69	cm²/m
C_b =	0,022	Mu_b =	**4,81**	kN.m	*Cuantía:*	0,0024	*As =*	1,68	cm²/m

Distribución de refuerzo inferior:

Sentido La *1#4c/0.2*

Sentido Lb *1#4c/0.2*

Distribución de refuerzo superior:

Sentido La *1#4c/0.2*

Sentido Lb *1#4c/0.2*

REVISIÓN A CORTANTE

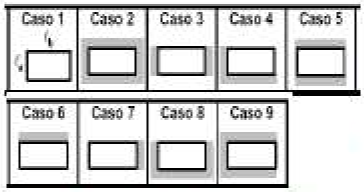
Coeficientes de relación de carga en las dos direcciones para cortante:

W_a = 0,76
W_b = 0,24

ϕvc =	**0,574**	**MPa**	
ϕvu_a =	**0,215**	**MPa**	**OK**
ϕvu_b =	**0,062**	**MPa**	**OK**

DISEÑO PLACA MACIZA TANQUES

El diseño de la placa maciza se realiza de acuerdo con lo establecido en C.13.9 de las NSR - 10



Geometría de la losa

la =	2,25	m	fy =	**420**	MPa
lb =	3,87	m	f'c =	**21,1**	MPa
Relación m =	**0,58**				

Espesor escogido: 0,15 **m**

Teniendo en cuenta que la relación m es mayor de 0.5, la placa maciza trabaja en dos direcciones

Cargas

Peso propio de la losa	0.15x1.0x24	3,60	kN/m²
Muros divisorios		2,00	kN/m²
Acabados	0.05x20	1,10	kN/m²
Carga Muerta Total		6,70	kN/m²
Carga Viva		5,00	kN/m²
Carga Última		16,04	kN/m²

Tipo de soporte CASO Nº 4

DISEÑO A MOMENTO FLECTOR

Coeficientes para momento positivo por carga muerta y viva:

C_{aD} = 0,043
C_{bD} = 0,013
C_{aV} = 0,052
C_{bV} = 0,016

Mua =	**2,77**	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m
Mu_b =	**2,50**	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m

Coeficientes para momento negativo por carga última:

C_a =	0,076	Mu_a =	**6,17**	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m
C_b =	0,024	Mu_b =	**5,77**	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m

Distribución de refuerzo inferior:

Sentido La *1#4c/0.2*

Sentido Lb *1#4c/0.2*

Distribución de refuerzo superior:

Sentido La *1#4c/0.2*

Sentido Lb *1#4c/0.2*

REVISIÓN A CORTANTE

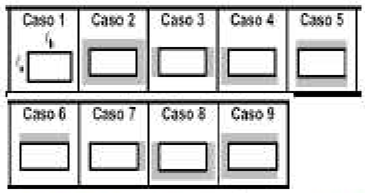
Coeficientes de relación de carga en las dos direcciones para cortante:

W_a = 0,76
W_b = 0,24

ϕvc =	**0,574**	**MPa**	
ϕvu_a =	**0,157**	**MPa**	**OK**
ϕvu_b =	**0,029**	**MPa**	**OK**

DISEÑO PLACA MACIZA TANQUES

El diseño de la placa maciza se realiza de acuerdo con lo establecido en C.13.9 de las NSR - 10



Geometría de la losa

la =	2,25	m	fy =	**420**	MPa
lb =	3,87	m	f'c =	**21,1**	MPa

Relación m = **0,58**

Espesor escogido: 0,15 **m**

Teniendo en cuenta que la relación m es mayor de 0.5, la placa maciza trabaja en dos direcciones

Cargas

Peso propio de la losa	0.15x1.0x24	3,60	kN/m²
Muros divisorios		2,00	kN/m²
Acabados	0.05x20	1,10	kN/m²
Carga Muerta Total		6,70	kN/m²
Carga Viva		5,00	kN/m²
Carga Última		16,04	kN/m²

Tipo de soporte CASO Nº 8

DISEÑO A MOMENTO FLECTOR

Coeficientes para momento positivo por carga muerta y viva:

C_{aD} = 0,036
C_{bD} = 0,013
C_{aV} = 0,049
C_{bV} = 0,016

Mua =	**2,46**	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m
Mu_b =	**2,50**	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m

Coeficientes para momento negativo por carga última:

C_a =	0,061	Mu_a =	**4,95**	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m
C_b =	0,036	Mu_b =	**8,65**	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m

Distribución de refuerzo inferior:

Sentido La *1#4c/0.2*

Sentido Lb *1#4c/0.2*

Distribución de refuerzo superior:

Sentido La *1#4c/0.2*

Sentido Lb *1#4c/0.2*

REVISIÓN A CORTANTE

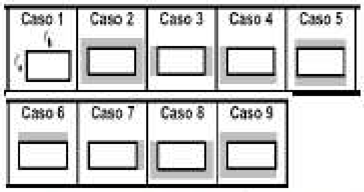
Coeficientes de relación de carga en las dos direcciones para cortante:

W_a = 0,61
W_b = 0,39

ϕvc =	**0,574**	**MPa**	
ϕvu_a =	**0,126**	**MPa**	**OK**
ϕvu_b =	**0,047**	**MPa**	**OK**

DISEÑO PLACA MACIZA TANQUES

El diseño de la placa maciza se realiza de acuerdo con lo establecido en C.13.9 de las NSR - 10



Geometría de la losa

la =	**1,95**	m	fy =	**420**	MPa
lb =	**2,25**	m	f'c =	**21,1**	MPa
Relación m =	**0,87**				

Espesor escogido: **0,15** **m**

Teniendo en cuenta que la relación m es mayor de 0.5, la placa maciza trabaja en dos direcciones

Cargas

Peso propio de la losa	0.15x1.0x24	3,60	kN/m²
Muros divisorios		2,00	kN/m²
Acabados	0.05x20	1,10	kN/m²
Carga Muerta Total		6,70	kN/m²
Carga Viva		5,00	kN/m²
Carga Última		16,04	kN/m²

Tipo de soporte CASO N° 4

DISEÑO A MOMENTO FLECTOR

Coeficientes para momento positivo por carga muerta y viva:

C_{aD} = 0,043
C_{bD} = 0,013
C_{aV} = 0,052
C_{bV} = 0,016

Mua =	**2,08**	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m
Mu_b =	**0,85**	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m

Coeficientes para momento negativo por carga última:

C_a =	0,076	Mu_a =	**4,64**	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m
C_b =	0,024	Mu_b =	**1,95**	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m

Distribución de refuerzo inferior:

Sentido La *1#4c/0.2*

Sentido Lb *1#4c/0.2*

Distribución de refuerzo superior:

Sentido La *1#4c/0.2*

Sentido Lb *1#4c/0.2*

REVISIÓN A CORTANTE

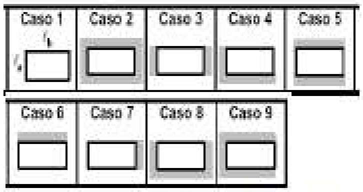
Coeficientes de relación de carga en las dos direcciones para cortante:

W_a = 0,76
W_b = 0,24

ϕvc =	**0,574**	**MPa**	
ϕvu_a =	**0,091**	**MPa**	**OK**
ϕvu_b =	**0,025**	**MPa**	**OK**

DISEÑO PLACA MACIZA TANQUES

El diseño de la placa maciza se realiza de acuerdo con lo establecido en C.13.9 de las NSR - 10



Geometría de la losa

la =	**1,95**	m	fy =	**420**	MPa
lb =	**2,25**	m	f'c =	**21,1**	MPa
Relación m =	**0,87**				

Espesor escogido: **0,15** **m**

Teniendo en cuenta que la relación m es mayor de 0.5, la placa maciza trabaja en dos direcciones

Cargas

Peso propio de la losa	0.15x1.0x24	3,60	kN/m²
Muros divisorios		2,00	kN/m²
Acabados	0.05x20	1,10	kN/m²
Carga Muerta Total		6,70	kN/m²
Carga Viva		5,00	kN/m²
Carga Última		16,04	kN/m²

Tipo de soporte CASO Nº 8

DISEÑO A MOMENTO FLECTOR

Coeficientes para momento positivo por carga muerta y viva:

C_{aD} = 0,036
C_{bD} = 0,013
C_{aV} = 0,049
C_{bV} = 0,016

Mua =	**1,85**	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m
Mu_b =	**0,85**	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m

Coeficientes para momento negativo por carga última:

C_a =	0,061	Mu_a =	**3,72**	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m
C_b =	0,036	Mu_b =	**2,92**	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m

Distribución de refuerzo inferior:

Sentido La *1#4c/0.2*

Sentido Lb *1#4c/0.2*

Distribución de refuerzo superior:

Sentido La *1#4c/0.2*

Sentido Lb *1#4c/0.2*

REVISIÓN A CORTANTE

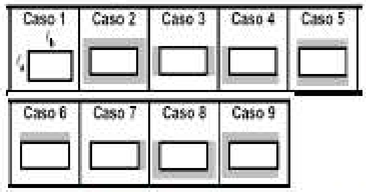
Coeficientes de relación de carga en las dos direcciones para cortante:

W_a = 0,61
W_b = 0,39

ϕvc =	**0,574**	**MPa**	
ϕvu_a =	**0,073**	**MPa**	**OK**
ϕvu_b =	**0,041**	**MPa**	**OK**

DISEÑO PLACA MACIZA TANQUES

El diseño de la placa maciza se realiza de acuerdo con lo establecido en C.13.9 de las NSR - 10



Geometría de la losa

la =	**1,95**	m	fy =	**420**	MPa
lb =	**3,55**	m	f'c =	**21,1**	MPa
Relación m =	**0,55**				

Espesor escogido: **0,15** **m**

Teniendo en cuenta que la relación m es mayor de 0.5, la placa maciza trabaja en dos direcciones

Cargas

Peso propio de la losa	0.15x1.0x24	3,60	kN/m²
Muros divisorios		2,00	kN/m²
Acabados	0.05x20	1,10	kN/m²
Carga Muerta Total		6,70	kN/m²
Carga Viva		5,00	kN/m²
Carga Última		16,04	kN/m²

Tipo de soporte CASO Nº 8

DISEÑO A MOMENTO FLECTOR

Coeficientes para momento positivo por carga muerta y viva:

$C_{aD} =$ 0,036
$C_{bD} =$ 0,013
$C_{av} =$ 0,049
$C_{bv} =$ 0,016

$Mu_a =$	**1,85**	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m
$Mu_b =$	**2,11**	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m

Coeficientes para momento negativo por carga última:

$C_a =$	0,061	$Mu_a =$	**3,72**	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m
$C_b =$	0,036	$Mu_b =$	**7,28**	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m

Distribución de refuerzo inferior:

Sentido La *1#4c/0.2*

Sentido Lb *1#4c/0.2*

Distribución de refuerzo superior:

Sentido La *1#4c/0.2*

Sentido Lb *1#4c/0.2*

REVISIÓN A CORTANTE

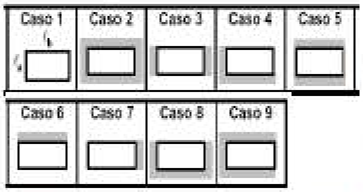
Coeficientes de relación de carga en las dos direcciones para cortante:

$W_a =$ 0,61
$W_b =$ 0,39

$\phi vc =$	**0,574**	**MPa**	
$\phi vu_a =$	**0,116**	**MPa**	**OK**
$\phi vu_b =$	**0,041**	**MPa**	**OK**

DISEÑO PLACA MACIZA TANQUES

El diseño de la placa maciza se realiza de acuerdo con lo establecido en C.13.9 de las NSR - 10



Geometría de la losa

la =	**1,95**	m	fy =	**420**	MPa
lb =	**3,55**	m	f'c =	**21,1**	MPa

Relación m = **0,55**

Espesor escogido: **0,15** **m**

Teniendo en cuenta que la relación m es mayor de 0.5, la placa maciza trabaja en dos direcciones

Cargas

Peso propio de la losa	0.15x1.0x24	3,60	kN/m²
Muros divisorios		2,00	kN/m²
Acabados	0.05x20	1,10	kN/m²
Carga Muerta Total		6,70	kN/m²
Carga Viva		5,00	kN/m²
Carga Última		16,04	kN/m²

Tipo de soporte CASO Nº 4

DISEÑO A MOMENTO FLECTOR

Coeficientes para momento positivo por carga muerta y viva:

C_{aD} = 0,043
C_{bD} = 0,013
C_{aV} = 0,052
C_{bV} = 0,016

Mua =	**2,08**	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m
Mu_b =	**2,11**	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m

Coeficientes para momento negativo por carga última:

C_a =	0,076	Mu_a =	**4,64**	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m
C_b =	0,024	Mu_b =	**4,85**	kN.m	*Cuantía:*	0,0020	*As =*	2,40 cm²/m

Distribución de refuerzo inferior:

Sentido La *1#4c/0.2*

Sentido Lb *1#4c/0.2*

Distribución de refuerzo superior:

Sentido La *1#4c/0.2*

Sentido Lb *1#4c/0.2*

REVISIÓN A CORTANTE

Coeficientes de relación de carga en las dos direcciones para cortante:

W_a = 0,76
W_b = 0,24

φvc =	**0,574**	**MPa**	
$φvu_a$ =	**0,144**	**MPa**	**OK**
$φvu_b$ =	**0,025**	**MPa**	**OK**

7.6 DISEÑO DE ELEMENTOS NO ESTRUCTURALES

DISEÑO DE ELEMENTOS NO ESTRUCTURALES

Units: kN*m

STORY DATA

Story	Height	Elevation	SimilarTo
N+6.95	3,5	6,95	None
N+3.45	3,5	3,45	None
BASE	0	-0,05	None

CENTER MASS RIGIDITY

Story	Diaphragm	MassX	MassY	XCM	YCM	CumMassX	CumMassY	XCCM	YCCM	XCR	YCR
N+6.95	D1	92,3315	92,3315	18,917	3,87	92,3315	92,3315	18,917	3,87	15,768	4,314
N+3.45	D1	221,9181	221,9181	14,915	3,384	314,2495	314,2495	16,091	3,527	16,169	4,519

STORY SHEARS

Story	Load	Loc	P	VX	VY	T	MX	MY
N+6.95	SISDISX	Top	0	225,39	65,73	1693,278	22,099	69,688
N+6.95	SISDISX	Bottom	0	225,39	65,73	1693,278	250,918	847,305
N+3.45	SISDISX	Top	0	427,54	126,39	3002,332	250,918	847,305
N+3.45	SISDISX	Bottom	0	427,54	126,39	3002,332	638,664	2320,865

$$F_p = \frac{a_x a_p}{R_p} gM_p \geq \frac{A_a I}{2} gM_p \qquad a_x = \frac{C_{vx} V_s}{m_x g} \leq 2 S_a \qquad C_{vx} = \frac{m_x h_x^k}{\sum_{i=1}^{n} (m_i h_i^k)}$$

$$V_s = S_a gM$$

g: 9,81 m/s^2
Sa: 0,250 g

Grupo de uso: III
Grado de desempeño: SUPERIOR

Grupo de Uso	Grado de desempeño
IV	SUPERIOR
III	SUPERIOR
II	BUENO
I	BAJO

Grado de desempeño de los elementos no estructurales: SUPERIOR

ANALISIS DE CARGAS PARA MUROS

Espesor de muros:	0,15 m
Espesor de pañete en una cara:	0 m
Densidad de mampostería:	13 kN/m3
Densidad mortero de pañete:	21 kN/m3
Altura Fachada:	6,95 m
Carga	13,5525 kN/m
Descripción:	mampostería reforzada, separada lateralmente de la estructura, apoyada arriba y abajo
ap:	1,0
Rp:	6

ANALISIS DE CARGAS PARA ANTEPECHOS

Espesor de muros:	0,15 m
Espesor de pañete en una cara:	0 m
Densidad de mampostería:	13 kN/m3
Densidad mortero de pañete:	21 kN/m3
Altura Antepecho:	1 m
Carga	1,95 kN/m
Descripción:	mampostería reforzada, separada lateralmente de la estructura, apoyada solo abajo
ap:	2,5
Rp:	6

Sección de vigas verticales: 0.15x0.25 m
f'c = 21,1 MPa
fy = 420 MPa

DISEÑO PARA MUROS

Story	Fx	Wx	ax	ap	Rp	Fp	M	V
N+6.95	225,39	92,33	0,500	1,0	6	1,129	6,819	3,925
N+3.45	202,15	221,92	0,500	1,0	6	1,129	6,819	3,925

	Sección Vigas V.			As. (cm2)		Separación column.		Fl. 1/4"
Story	b	d	ρ	neces.	ubicado	S max	$S_{escogida}$	$S_{estribos}$
N+6.95	0.15	0,21	0,00253	0,80	1,29	1,62	1,60	0,188
N+3.45	0.15	0,21	0,00253	0,80	1,29	1,62	1,60	0,188

DISEÑO PARA ANTEPECHOS

Story	Fx	Wx	ax	ap	Rp	Fp	M	V
N+6.95	225,39	92,33	0,500	2,5	6	2,823	17,047	9,811
N+3.45	202,15	221,92	0,500	2,5	6	2,823	17,047	9,811

	Sección columneta			As. (cm2)		Separación column.		Fl. 1/4"
Story	b	d	ρ	neces.	ubicado	S max	$S_{escogida}$	$S_{estribos}$
N+6.95	0.15	0,21	0,00666	2,10	2,84	1,35	1,40	0,188
N+3.45	0.15	0,21	0,00666	2,10	2,84	1,35	1,40	0,188

8 ESPECIFICACIONES TÉCNICAS

Los materiales utilizados son:

Concreto 21.1 MPa para vigas, placas, zapatas y

columnas. Concreto 14 MPa (para concreto de limpieza).

Acero para refuerzo fy = 420 MPa para todos los diámetros.

Acero estructural A36 pernos de anclaje y platinas

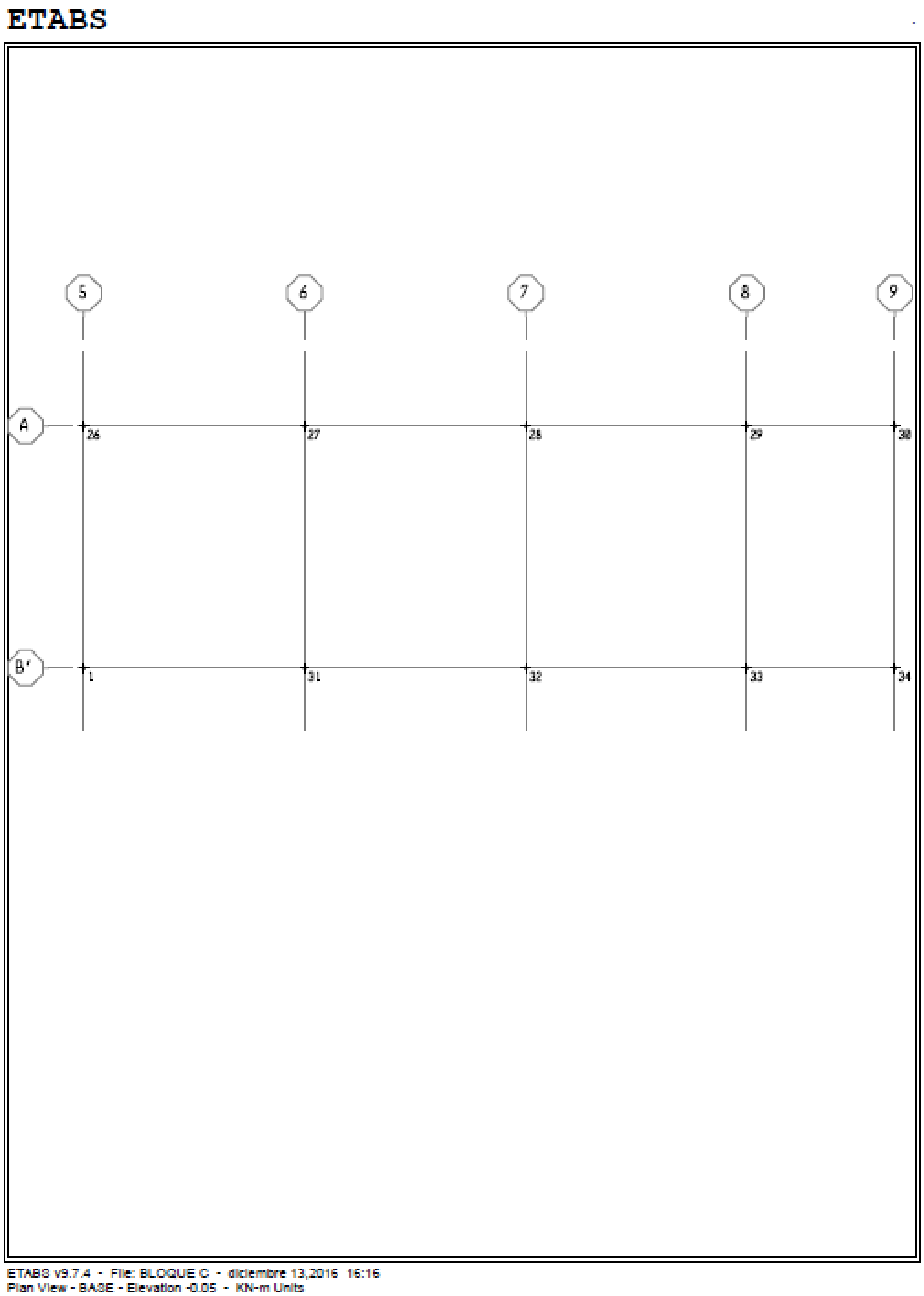
Acero estructural A500 en perfiles metálicos

9 CONCLUSIONES Y RECOMENDACIONES

Habiendo finalizado el diseño y análisis estructural de la institución educativa Alfredo Bonilla sede No 2 Maria Inmaculada Grupo 002 basado en la Norma Colombiana de Diseño y Construcción Sismo Resistente Ley 400 de 1997 (Modificada Ley 1229 de 2008) y Decreto 926 de Marzo de 2010, Decreto 092 del 17 de Enero de 2011, Decreto 0340 del 13 de Febrero de 2012 y en el Reglamento para Concreto Estructural ACI 318S-08, hemos llegado a las siguientes conclusiones y recomendaciones.

- Se cumplió satisfactoriamente con los objetivos del cálculo y diseño estructural mediante la aplicación de la norma sismo resistente (NSR-10) y el reglamento para concreto estructural ACI 318S-08, además de la ayuda del software ETABS V9.7.4 se puede garantizar el buen funcionamiento de la estructura que presenta una buena respuesta ante un evento sísmico.
- La revisión de los desplazamientos laterales (derivas) de la estructura teniendo en cuenta las direcciones "X" y "y", nos arrojó que los resultados obtenidos son aceptables permitiendo un buen funcionamiento ante la actuación de un sismo y que cumple con lo establecido en la norma sismo resistente (NSR-10).
- En cuanto a la revisión de columnas y vigas determinamos que cumplen con los requisitos, ya que en estructuras de edificios aporticados es obligatorio que los miembros horizontales fallen antes que los verticales, permitiendo de esa manera un retraso del colapso total de la estructura.
- Para la construcción de la estructura se recomienda llevar un estricto control en la calidad de los materiales a utilizar, ya que estos deberán cumplir con requisitos especiales para el buen funcionamiento de la edificación. Además que estos deberán ser supervisados a la hora de la puesta en marcha por el ingeniero residente.

9 ANEXOS


ETABS
5
6
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A
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1
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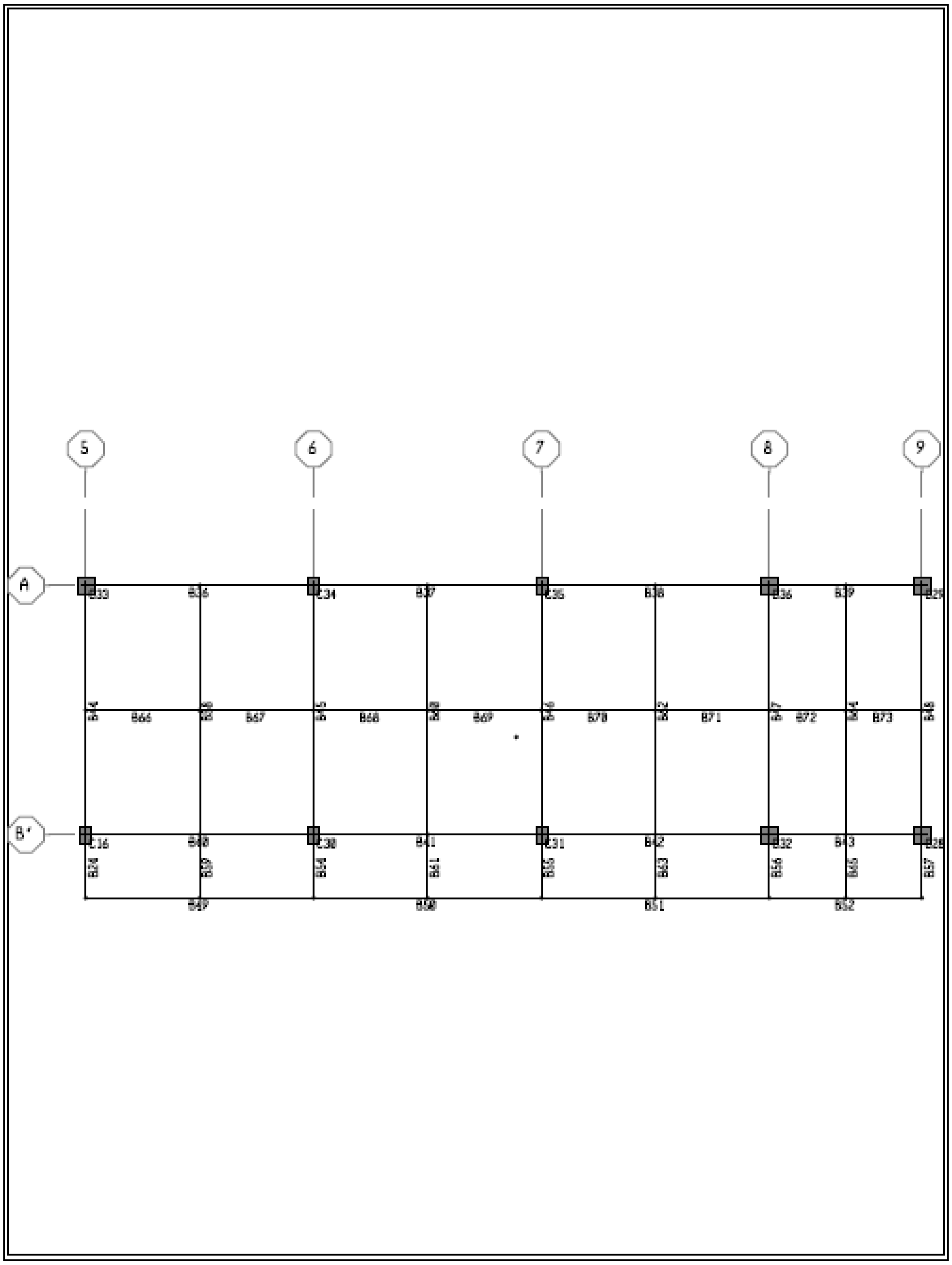
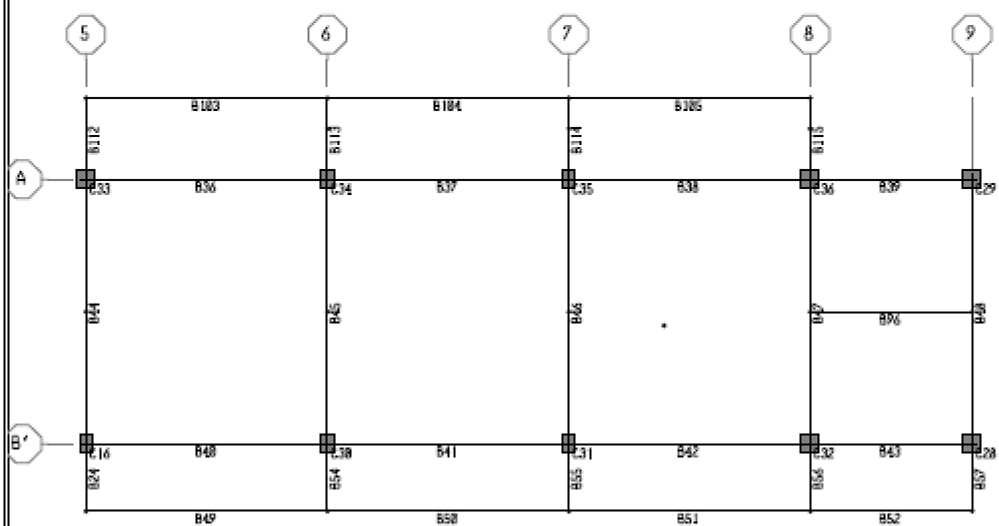
34
ETABS v9.7.4 - File: BLOQUE C - diciembre 13,2016 16:16
Plan View - BASE - Elevation -0.05 - KN-m Units

ETABS



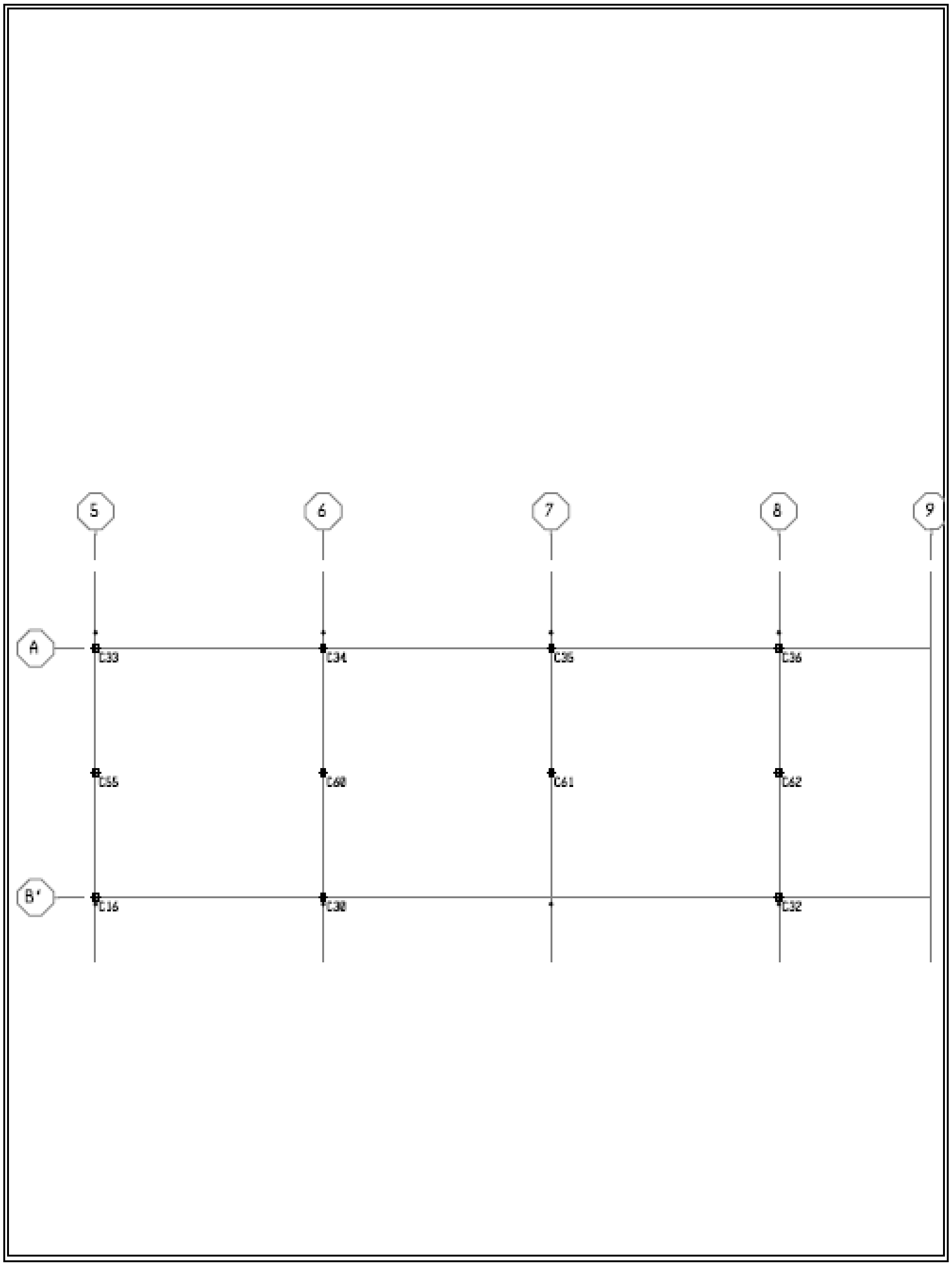
ETABS v9.7.4 - File: BLOQUE C - diciembre 13,2016 16:17
Plan View - N+3.45 - Elevation 3.45 - KN-m Units

ETABS



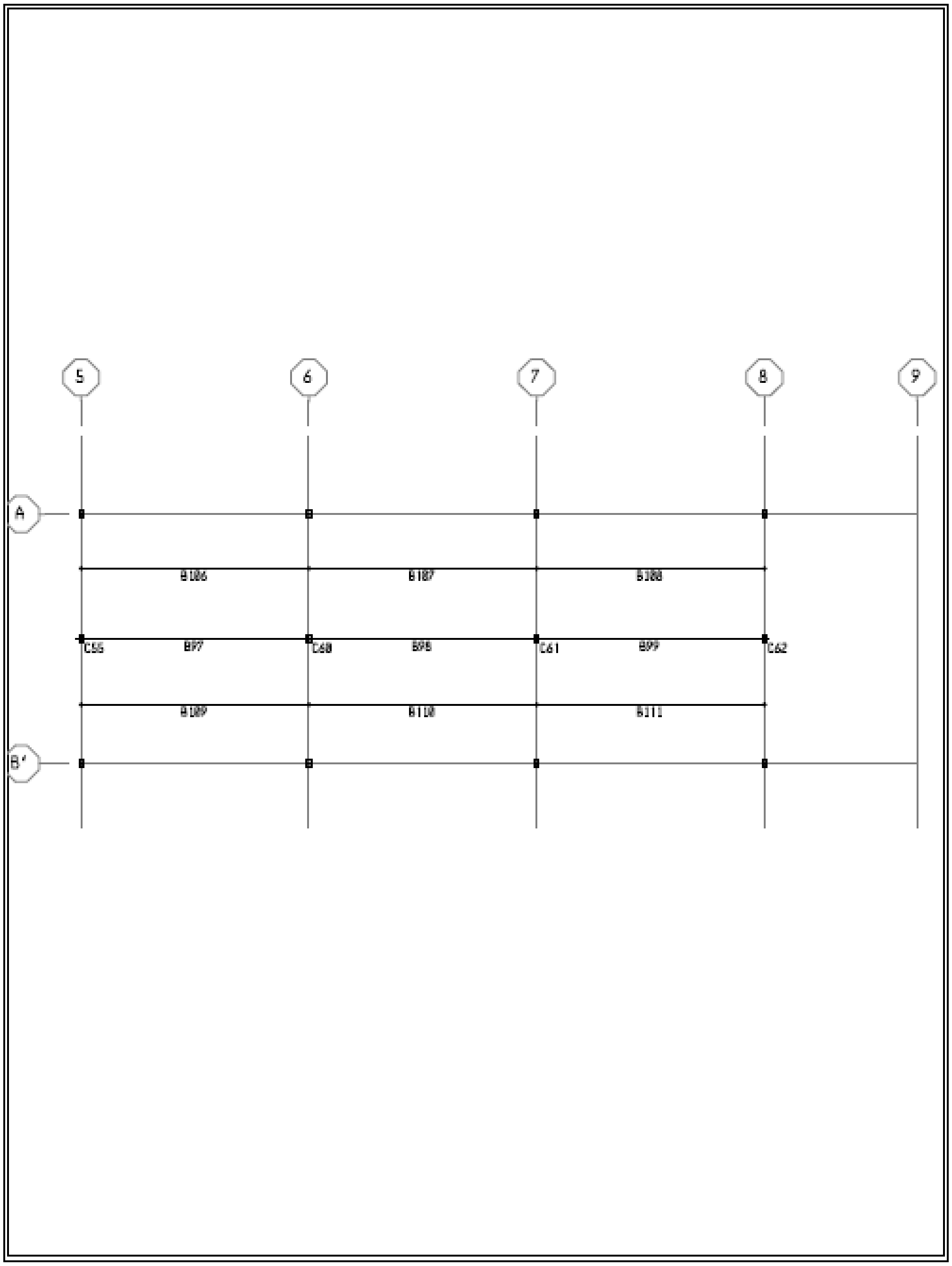
ETABS v9.7.4 - File: BLOQUE C - diciembre 13,2016 16:18
Plan View - N+6.95 - Elevation 6.95 - KN-m Units

ETABS



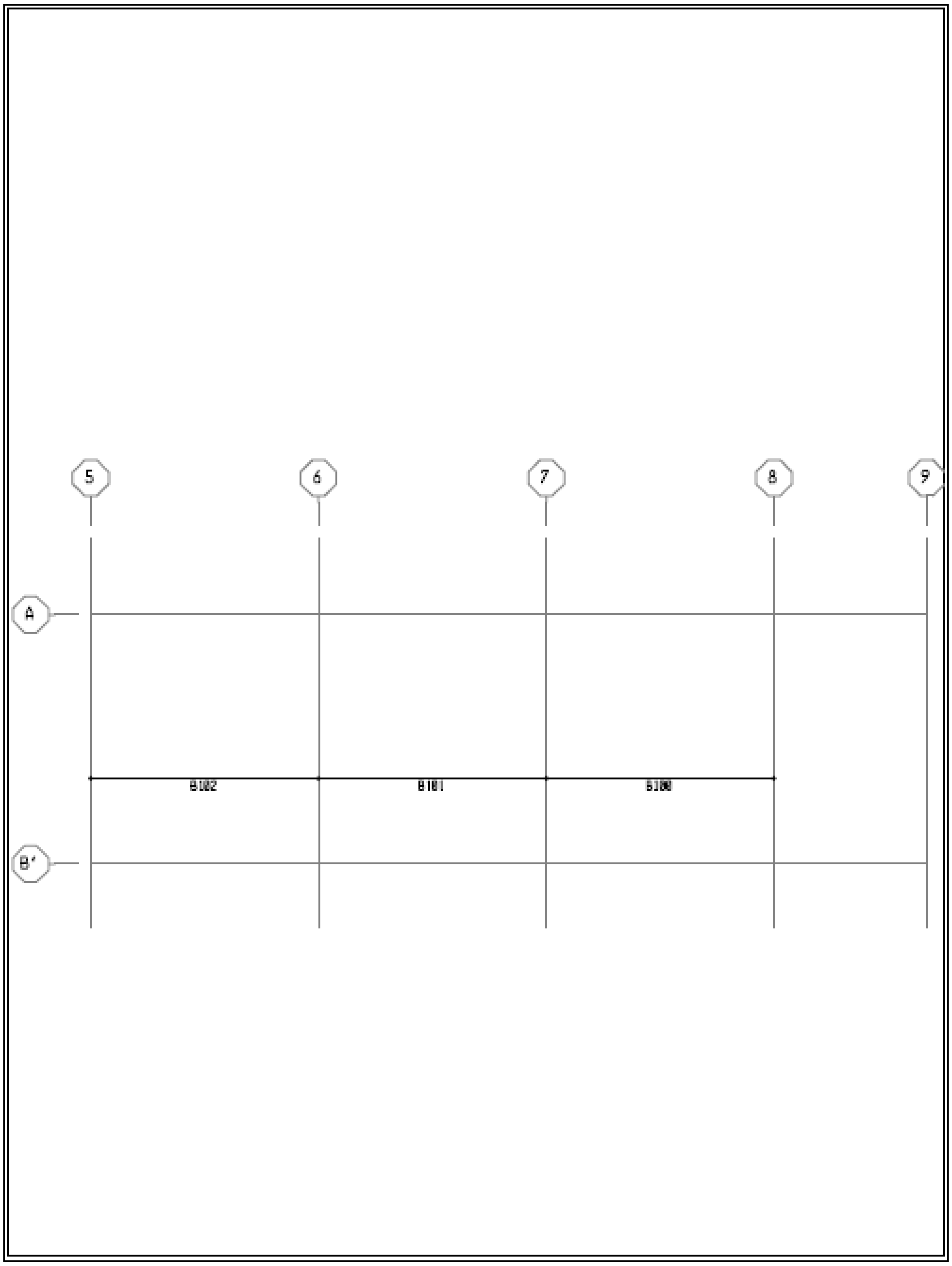
ETABS v9.7.4 - File: BLOQUE C - diciembre 13,2016 16:18
Plan View - N+7.45 - Elevation 7.6 - KN-m Units

ETABS



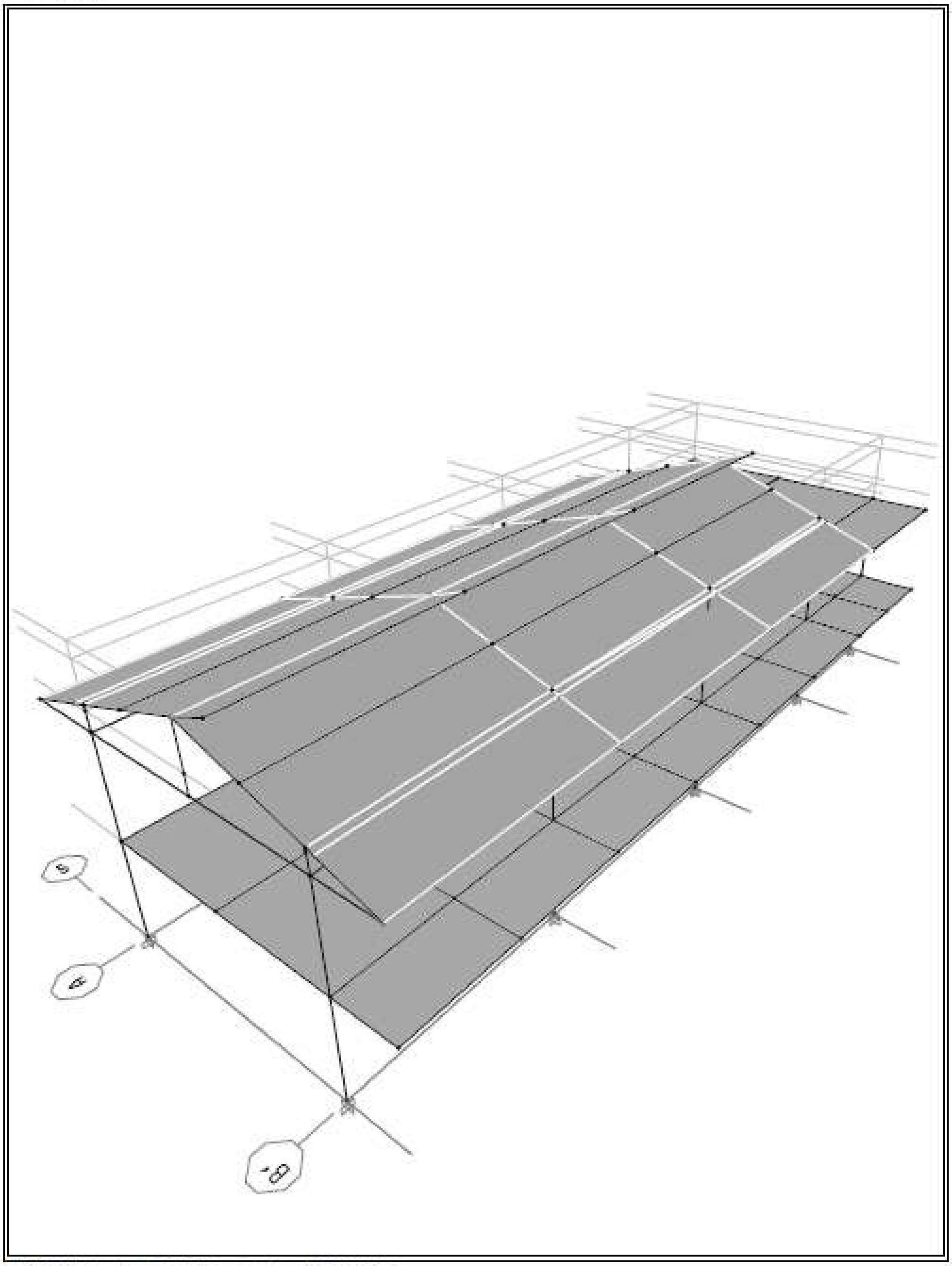
ETABS v9.7.4 - File: BLOQUE C - diciembre 13,2016 16:19
Plan View - N+8.85 - Elevation 9.1 - KN-m Units

ETABS



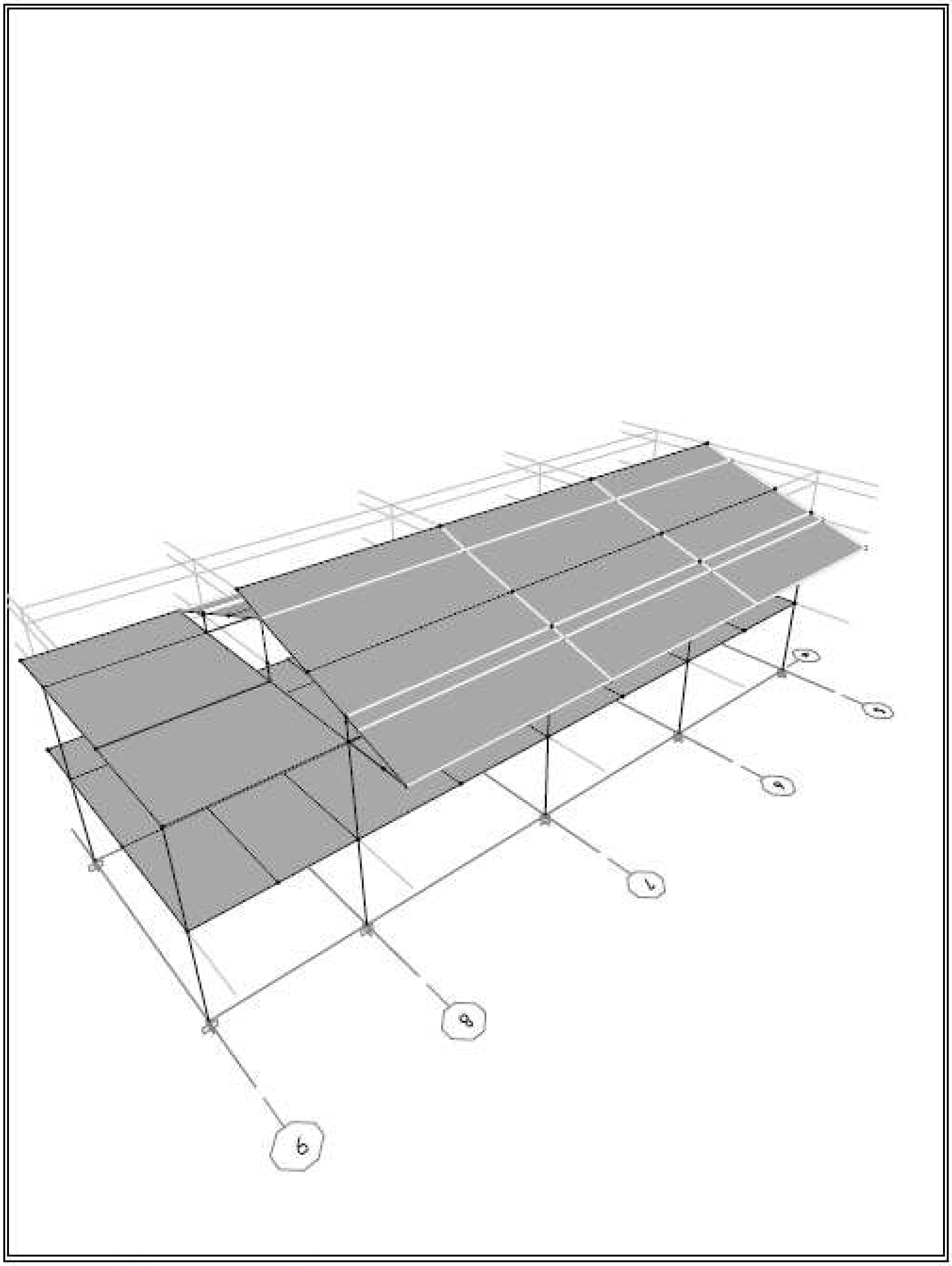
ETABS v9.7.4 - File: BLOQUE C - diciembre 13,2016 16:19
Plan View - N+9.29 - Elevation 9.6 - KN-m Units

ETABS



ETABS v9.7.4 - File: BLOQUE C - diciembre 13,2016 16:20
3-D View - KN-m Units

ETABS



ETABS v9.7.4 - File: BLOQUE C - diciembre 13,2016 16:21
3-D View - KN-m Units

9.1 DATOS DE ENTRADA

ETABS v9.7.4 File:BLOQUE C Units:KN-m diciembre 12, 2016 19:05 PAGE 1

S T O R Y   D A T A

STORY	SIMILAR TO	HEIGHT	ELEVATION
N+9.29	None	0.500	9.600
N+8.85	None	1.500	9.100
N+7.45	None	0.650	7.600
N+6.95	None	3.500	6.950
N+3.45	None	3.500	3.450
BASE	None		-0.050

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

POINT	X	Y	DZ-BELOW
1	0.000	0.000	0.000
19	0.000	-2.200	0.000
26	0.000	8.640	0.000
27	7.900	8.640	0.000
28	15.800	8.640	0.000
29	23.700	8.640	0.000
30	29.000	8.640	0.000
31	7.900	0.000	0.000
32	15.800	0.000	0.000
33	23.700	0.000	0.000
34	29.000	0.000	0.000
35	7.900	-2.200	0.000
36	15.800	-2.200	0.000
37	23.700	-2.200	0.000
38	29.000	-2.200	0.000
41	3.950	8.640	0.000
42	3.950	0.000	0.000
43	3.950	-2.200	0.000
44	11.850	8.640	0.000
45	11.850	0.000	0.000
46	11.850	-2.200	0.000
47	19.750	8.640	0.000
48	19.750	0.000	0.000
49	19.750	-2.200	0.000
50	26.350	8.640	0.000
51	26.350	0.000	0.000
52	26.350	-2.200	0.000
53	0.000	4.320	0.000
54	3.950	4.320	0.000
55	7.900	4.320	0.000
56	11.850	4.320	0.000
57	15.800	4.320	0.000
58	19.750	4.320	0.000
59	23.700	4.320	0.000
60	26.350	4.320	0.000
61	29.000	4.320	0.000
88	7.900	10.300	0.000
89	15.800	10.300	0.000
90	23.700	10.300	0.000
199	0.000	11.300	0.000
200	0.000	2.970	0.000
203	0.000	-0.229	0.000
204	0.000	9.190	0.000
1-2	0.000	0.000	1.425
26-1	0.000	8.640	1.331
214	7.900	-0.229	0.000
215	7.900	11.300	0.000
216	7.900	9.190	0.000
217	7.900	2.970	0.000
31-2	7.900	0.000	1.425
27-2	7.900	8.640	1.331
218	15.800	-0.229	0.000
219	15.800	11.300	0.000
220	15.800	9.190	0.000
221	15.800	2.970	0.000
32-2	15.800	0.000	1.425
28-2	15.800	8.640	1.331
222	23.700	-0.229	0.000

223	23.700	11.300	0.000
224	23.700	9.190	0.000
225	23.700	2.970	0.000
33-2	23.700	0.000	1.425
29-2	23.700	8.640	1.331
360	0.000	6.755	0.000
360-1	0.000	6.755	0.750
361	7.900	6.755	0.000
361-1	7.900	6.755	0.750
362	15.800	6.755	0.000
362-1	15.800	6.755	0.750
363	23.700	6.755	0.000
363-1	23.700	6.755	0.750
364	0.000	2.046	0.000
364-1	0.000	2.046	0.750
365	7.900	2.046	0.000
365-1	7.900	2.046	0.750
366	15.800	2.046	0.000
366-1	15.800	2.046	0.750
367	23.700	2.046	0.000
367-1	23.700	2.046	0.750

ETABS v9.7.4 File:BLOQUE C Units:KN-m diciembre 12, 2016 19:05 PAGE 3

C O L U M N   C O N N E C T I V I T Y   D A T A

COLUMN	I END PT	J END PT	I END STORY
C16	1	1	Below
C28	34	34	Below
C29	30	30	Below
C30	31	31	Below
C31	32	32	Below
C32	33	33	Below
C33	26	26	Below
C34	27	27	Below
C35	28	28	Below
C36	29	29	Below
C55	53	53	Below
C16-2	1	1-2	Below
C33-1	26	26-1	Below
C60	55	55	Below
C30-2	31	31-2	Below
C34-2	27	27-2	Below
C61	57	57	Below
C35-2	28	28-2	Below
C62	59	59	Below
C32-2	33	33-2	Below
C31-2	32	32-2	Same
C36-1	29	29-2	Below

ETABS v9.7.4 File:BLOQUE C Units:KN-m diciembre 12, 2016 19:05 PAGE 4

B E A M   C O N N E C T I V I T Y   D A T A

BEAM	I END PT	J END PT
B24	19	1
B36	26	27
B37	27	28
B38	28	29
B39	29	30
B40	1	31
B41	31	32
B42	32	33
B43	33	34
B44	1	26
B45	31	27
B46	32	28
B47	33	29
B48	34	30
B49	19	35
B50	35	36
B51	36	37
B52	37	38
B54	35	31
B55	36	32
B56	37	33

B57	38	34
B58	41	42
B59	42	43
B60	44	45
B61	45	46
B62	47	48
B63	48	49
B64	50	51
B65	51	52
B66	53	54
B67	54	55
B68	55	56
B69	56	57
B70	57	58
B71	58	59
B72	59	60
B73	60	61
B96	59	61
B97	53	55
B98	55	57
B99	57	59
B100	221	225
B101	217	221
B102	200	217
B103	199	215
B104	215	219
B105	219	223
B106	360-1	361-1
B107	361-1	362-1
B108	362-1	363-1
B109	364-1	365-1
B110	365-1	366-1
B111	366-1	367-1
B112	26	199
B113	27	215
B114	28	219
B115	29	223

ETABS v9.7.4 File:BLOQUE C Units:KN-m diciembre 12, 2016 19:05 PAGE 5

B R A C E   C O N N E C T I V I T Y   D A T A

BRACE	I END PT	J END PT	I END STORY
D95	19	203	Below
D96	203	53	Below
D98	199	204	Below
D99	204	53	Below
D100	53	200	Below
D110	35	214	Below
D111	215	216	Below
D112	55	217	Below
D113	214	55	Below
D114	216	55	Below
D115	36	218	Below
D116	219	220	Below
D117	57	221	Below
D118	218	57	Below
D119	220	57	Below
D120	37	222	Below
D121	223	224	Below
D122	59	225	Below
D123	222	59	Below
D124	224	59	Below

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R I G I D   D I A P H R A G M   P O I N T   C O N N E C T I V I T Y   D A T A

STORY	DIAPHRAGM	POINT	POINT	POINT	POINT	POINT
N+6.95	D1	26	27	28	29	30
		1	31	32	33	34
		19	35	36	37	38
		88	89	90	199	53
		215	55	219	57	223
		59	61			

N+3.45	D1	26	27	28	29	30
		1	31	32	33	34
		19	35	36	37	38
		41	42	43	44	45
		46	47	48	49	50
		51	52	53	54	55
		56	57	58	59	60
		61				

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M A T E R I A L   P R O P E R T Y   D A T A

MATERIAL NAME	MATERIAL TYPE	DESIGN TYPE	MATERIAL DIR/PLANE	MODULUS OF ELASTICITY	POISSON'S RATIO	THERMAL COEFF	SHEAR MODULUS
STEEL	Iso	Steel	All	199947978.80	0.3000	1.1700E-05	76903068.77
CONC21	Iso	Concrete	All	21538000.000	0.2000	9.9000E-06	8974166.667
OTHER	Iso	None	All	199947978.80	0.3000	1.1700E-05	76903068.77
A500	Iso	Steel	All	199900000.00	0.3000	1.1700E-05	76884615.38
CUB	Iso	Concrete	All	0.000	0.2000	9.9000E-06	0.000

M A T E R I A L   P R O P E R T Y   M A S S   A N D   W E I G H T

MATERIAL NAME	MASS PER UNIT VOL	WEIGHT PER UNIT VOL
STEEL	7.8271E+00	7.6820E+01
CONC21	2.4000E+00	2.4000E+01
OTHER	7.8271E+00	7.6820E+01
A500	7.8271E+00	7.6820E+01
CUB	2.4000E+00	0.0000E+00

M A T E R I A L   D E S I G N   D A T A   F O R   S T E E L   M A T E R I A L S

MATERIAL NAME	STEEL FY	STEEL FU	STEEL COST ($)
STEEL	344737.894	448159.263	271447.16
A500	352000.000	400000.000	5000.00

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

MATERIAL NAME	LIGHTWEIGHT CONCRETE	CONCRETE FC	REBAR FY	REBAR FYS	LIGHTWT REDUC FACT
CONC21	No	21000.000	420000.000	420000.000	N/A
CUB	No	21000.000	420000.000	420000.000	N/A

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

FRAME SECTION NAME	MATERIAL NAME	SECTION SHAPE NAME OR NAME IN SECTION DATABASE FILE	CONC COL	CONC BEAM
VIG40X45	CONC21	Rectangular		Yes
VIG20X45	CONC21	Rectangular		Yes
COL60X40	CONC21	Rectangular	Yes	
250X150X5	A500	Box/Tube		
PERFILCOL	A500	Box/Tube		
VIG30X45	CONC21	Rectangular		Yes
VIG15X45	CONC21	Rectangular		Yes
COL60X60	CONC21	Rectangular	Yes	

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

FRAME SECTION NAME	SECTION DEPTH	FLANGE WIDTH TOP	FLANGE THICK TOP	WEB THICK	FLANGE WIDTH BOT	FLANGE THICK BOT
VIG40X45	0.4500	0.4000	0.0000	0.0000	0.0000	0.0000
VIG20X45	0.4500	0.2000	0.0000	0.0000	0.0000	0.0000
COL60X40	0.4000	0.6000	0.0000	0.0000	0.0000	0.0000

250X150X5	0.2500	0.1500	0.0050	0.0050	0.0000	0.0000
PERFILCOL	0.1500	0.2500	0.0050	0.0050	0.0000	0.0000
VIG30X45	0.4500	0.3000	0.0000	0.0000	0.0000	0.0000
VIG15X45	0.4500	0.1500	0.0000	0.0000	0.0000	0.0000
COL60X60	0.6000	0.6000	0.0000	0.0000	0.0000	0.0000

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

FRAME SECTION NAME	SECTION AREA	TORSIONAL CONSTANT	MOMENTS OF INERTIA I33	I22	SHEAR AREAS A2	A3
VIG40X45	0.1800	0.0045	0.0030	0.0024	0.1500	0.1500
VIG20X45	0.0900	0.0009	0.0015	0.0003	0.0750	0.0750
COL60X40	0.2400	0.0075	0.0032	0.0072	0.2000	0.2000
250X150X5	0.0039	0.0000	0.0000	0.0000	0.0025	0.0015
PERFILCOL	0.0039	0.0000	0.0000	0.0000	0.0015	0.0025
VIG30X45	0.1350	0.0024	0.0023	0.0010	0.1125	0.1125
VIG15X45	0.0675	0.0004	0.0011	0.0001	0.0563	0.0563
COL60X60	0.3600	0.0183	0.0108	0.0108	0.3000	0.3000

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

FRAME SECTION NAME	SECTION MODULI S33	S22	PLASTIC MODULI Z33	Z22	RADIUS OF GYRATION R33	R22
VIG40X45	0.0135	0.0120	0.0203	0.0180	0.1299	0.1155
VIG20X45	0.0068	0.0030	0.0101	0.0045	0.1299	0.0577
COL60X40	0.0160	0.0240	0.0240	0.0360	0.1155	0.1732
250X150X5	0.0003	0.0002	0.0003	0.0002	0.0934	0.0629
PERFILCOL	0.0002	0.0003	0.0002	0.0003	0.0629	0.0934
VIG30X45	0.0101	0.0068	0.0152	0.0101	0.1299	0.0866
VIG15X45	0.0051	0.0017	0.0076	0.0025	0.1299	0.0433
COL60X60	0.0360	0.0360	0.0540	0.0540	0.1732	0.1732

F R A M E   S E C T I O N   W E I G H T S   A N D   M A S S E S

FRAME SECTION NAME	TOTAL WEIGHT	TOTAL MASS
VIG40X45	1276.3872	127.6387
VIG20X45	51.1920	5.1192
COL60X40	201.6000	20.1600
250X150X5	66.4727	6.7729
PERFILCOL	4.4278	0.4511
VIG30X45	17.1720	1.7172
VIG15X45	8.5860	0.8586
COL60X60	302.4000	30.2400

C O N C R E T E   C O L U M N   D A T A

FRAME SECTION NAME	REINF CONFIGURATION LONGIT	LATERAL	REINF SIZE/TYPE	NUM BARS 3DIR/2DIR	NUM BARS CIRCULAR	BAR COVER
COL60X40	Rectangular	Ties	#9/Design	3/3	N/A	0.0457
COL60X60	Rectangular	Ties	#9/Design	3/3	N/A	0.0457

C O N C R E T E   B E A M   D A T A

FRAME SECTION NAME	TOP COVER	BOT COVER	TOP LEFT AREA	TOP RIGHT AREA	BOT LEFT AREA	BOT RIGHT AREA
VIG40X45	0.0500	0.0500	0.000	0.000	0.000	0.000
VIG20X45	0.0500	0.0500	0.000	0.000	0.000	0.000
VIG30X45	0.0457	0.0457	0.000	0.000	0.000	0.000
VIG15X45	0.0457	0.0457	0.000	0.000	0.000	0.000

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

SHELL   MATERIAL   SHELL   LOAD DIST   MEMBRANE   BENDING   TOTAL   TOTAL

SECTION	NAME	TYPE	ONE WAY	THICK	THICK	WEIGHT	MASS
CUBLIV	CUB	Membrane	Yes	0.0130	0.0130	0.0000	11.5416
CUBMACSAL2	CONC21	Membrane	No	0.1460	0.1460	1101.5174	110.1517
CUBMACTAN2	CONC21	Membrane	No	0.1960	0.1960	270.2542	27.0254

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

STATIC CASE	CASE TYPE	AUTO LAT LOAD	SELF WT MULTIPLIER	NOTIONAL FACTOR	NOTIONAL DIRECTION
DEAD	DEAD	N/A	1.0000		
LIVE	LIVE	N/A	0.0000		
VIENTO	WIND	None	0.0000		

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R E S P O N S E   S P E C T R U M   C A S E S

RESP SPEC CASE: SISDERX

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0500	0.0000	0.0500

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	DERIVAS	10.1940
U2	----	N/A
UZ	----	N/A

RESP SPEC CASE: SISDERY

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0500	0.0000	0.0500

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	----	N/A
U2	DERIVAS	11.6690
UZ	----	N/A

RESP SPEC CASE: SISDISX

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0500	0.0000	0.0500

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	DISENO	10.1940
U2	----	N/A
UZ	----	N/A

RESP SPEC CASE: SISDISY

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0500	0.0000	0.0500

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	----	N/A
U2	DISENO	11.6690
UZ	----	N/A

RESP SPEC CASE: SISUMBX

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0200	0.0000	0.0200

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	UMBRAL	11.3800
U2	----	N/A
UZ	----	N/A

RESP SPEC CASE: SISUMBY

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0200	0.0000	0.0200

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	----	N/A
U2	UMBRAL	13.1590
UZ	----	N/A

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L O A D I N G   C O M B I N A T I O N S

COMBO	COMBO TYPE	CASE	CASE TYPE	SCALE FACTOR
CIM1	ADD	DEAD	Static	1.0000
		LIVE	Static	1.0000
COMDIS1	ADD	DEAD	Static	1.4000
COMDIS2	ADD	DEAD	Static	1.2000
		LIVE	Static	1.6000
COMDIS3	ADD	DEAD	Static	1.2000
		LIVE	Static	1.0000
		SISDISX	Spectra	1.0000
		SISDISY	Spectra	0.3000
COMDIS4	ADD	DEAD	Static	1.2000
		LIVE	Static	1.0000
		SISDISX	Spectra	0.3000
		SISDISY	Spectra	1.0000
COMDIS5	ADD	DEAD	Static	0.9000
		SISDISX	Spectra	1.0000

		SISDISY	Spectra	0,3000
COMDIS6	ADD	DEAD	Static	0,9000
		SISDISX	Spectra	0,3000
		SISDISY	Spectra	1,0000
CIM2	ADD	DEAD	Static	1,0000
		LIVE	Static	0,7500
		SISDISX	Spectra	0,5250
		SISDISY	Spectra	0,1575
CIM3	ADD	DEAD	Static	1,0000
		LIVE	Static	0,7500
		SISDISX	Spectra	0,1575
		SISDISY	Spectra	0,5250
COMDER1	ADD	SISDERX	Spectra	1,0000
		SISDERY	Spectra	0,3000
COMDER2	ADD	SISDERX	Spectra	0,3000
		SISDERY	Spectra	1,0000
COMDERUMB1	ADD	SISUMBX	Spectra	1,0000
		SISUMBY	Spectra	0,3000
COMDERUMB2	ADD	SISUMBX	Spectra	0,3000
		SISUMBY	Spectra	1,0000
COMDIS7	ADD	DEAD	Static	1,2000
		LIVE	Static	1,6000
		VIENTO	Static	0,8000
COMDIS8	ADD	DEAD	Static	1,2000
		VIENTO	Static	1,6000
		LIVE	Static	1,0000
COMDIS9	ADD	DEAD	Static	0,9000
		VIENTO	Static	1,6000
COMDIS10	ADD	LIVE	Static	1,6000
		DEAD	Static	1,2000
		VIENTO	Static	-0,8000
COMDIS11	ADD	DEAD	Static	0,9000
		VIENTO	Static	-1,6000
ENVOLVENTE	ENVE	COMDIS1	Combo	1,0000
		COMDIS2	Combo	1,0000
		COMDIS3	Combo	1,0000
		COMDIS4	Combo	1,0000
		COMDIS5	Combo	1,0000
		COMDIS6	Combo	1,0000
		COMDIS7	Combo	1,0000
		COMDIS8	Combo	1,0000
		COMDIS9	Combo	1,0000
		COMDIS10	Combo	1,0000
		COMDIS11	Combo	1,0000

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R E S P O N S E S P E C T R U M F U N C T I O N - F R O M F I L E

FUNCTION NAME: DERIVAS

FILE NAME: c:\users\dyein_000\desktop\cristian\maria inmaculada\modelo\bloque c\derivas.txt
DATA TYPE: Period vs Acceleration
NUMBER OF HEADER LINES = 0

PERIOD	ACCEL
0.0000	1.1330
0.0500	1.1330
0.1000	1.1330
0.1600	1.1330
0.2100	1.1330
0.4000	1.1330
0.6000	1.1330
0.8000	1.1330
0.9900	1.1330
1.3400	0.8410
1.6800	0.6690
2.0300	0.5550
2.3700	0.4740
2.7200	0.4140
3.0600	0.3670
3.4100	0.3300
3.7500	0.3000
4.1000	0.2750
4.4400	0.2530
4.7900	0.2350

5.1300	0.2190
5.4800	0.2050
5.8200	0.1930
6.1700	0.1820
6.5100	0.1730
6.8600	0.1640
7.2000	0.1560
8.2000	0.1200
9.2000	0.0960

FUNCTION NAME: DISENO

FILE NAME: c:\users\dyein_000\desktop\cristian\maria inmaculada\modelo\bloque c\diseño.txt
DATA TYPE: Period vs Acceleration
NUMBER OF HEADER LINES = 0

PERIOD	ACCEL
0.0000	0.1618
0.0500	0.1618
0.1000	0.1618
0.1600	0.1618
0.2100	0.1618
0.4000	0.1618
0.6000	0.1618
0.8000	0.1618
0.9900	0.1618
1.3400	0.1201
1.6800	0.0955
2.0300	0.0793
2.3700	0.0677
2.7200	0.0591
3.0600	0.0525
3.4100	0.0472
3.7500	0.0428
4.1000	0.0392
4.4400	0.0362
4.7900	0.0336
5.1300	0.0313
5.4800	0.0293
5.8200	0.0276
6.1700	0.0261
6.5100	0.0247
6.8600	0.0234
7.2000	0.0223
8.2000	0.0172
9.2000	0.0137

FUNCTION NAME: UMBRAL

FILE NAME: c:\users\dyein_000\desktop\cristian\maria inmaculada\modelo\bloque c\umbral.txt
DATA TYPE: Period vs Acceleration
NUMBER OF HEADER LINES = 0

PERIOD	ACCEL
0.0000	0.0900
0.0500	0.1260
0.1000	0.1620
0.1500	0.1980
0.2000	0.2340
0.2500	0.2700
0.4900	0.2700
0.7300	0.2700
0.9800	0.2700
1.2200	0.2700
1.4600	0.2700
1.7000	0.2700
1.9500	0.2700
2.1900	0.2700
2.7800	0.2120
3.3800	0.1750
3.9700	0.1490
4.5600	0.1290

5.1600	0.1150
5.7500	0.1030
6.3400	0.0930
6.9400	0.0850
7.5300	0.0780
8.1300	0.0730
8.7200	0.0680
9.3100	0.0630
9.9100	0.0600
10.5000	0.0560
11.5000	0.0470
12.5000	0.0400

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F R A M E   S E C T I O N   A S S I G N M E N T S   T O   L I N E   O B J E C T S

STORY LEVEL	LINE ID	LINE TYPE	SECTION TYPE	AUTO SELECT SECTION	ANALYSIS SECTION	DESIGN PROCEDURE	DESIGN SECTION
N+8.85	C55	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+8.85	C16-2	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+8.85	C33-1	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+8.85	C60	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+8.85	C30-2	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+8.85	C34-2	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+8.85	C61	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+8.85	C35-2	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+8.85	C62	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+8.85	C32-2	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+8.85	C31-2	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+8.85	C36-1	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+7.45	C16	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+7.45	C30	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+7.45	C32	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+7.45	C33	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+7.45	C34	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+7.45	C35	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+7.45	C36	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+7.45	C55	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+7.45	C60	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+7.45	C61	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+7.45	C62	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+6.95	C16	Column	Rectangular	None	COL60X40	Conc Frame	COL60X40
N+6.95	C28	Column	Rectangular	None	COL60X60	Conc Frame	COL60X60
N+6.95	C29	Column	Rectangular	None	COL60X60	Conc Frame	COL60X60
N+6.95	C30	Column	Rectangular	None	COL60X40	Conc Frame	COL60X40
N+6.95	C31	Column	Rectangular	None	COL60X40	Conc Frame	COL60X40
N+6.95	C32	Column	Rectangular	None	COL60X60	Conc Frame	COL60X60
N+6.95	C33	Column	Rectangular	None	COL60X60	Conc Frame	COL60X60
N+6.95	C34	Column	Rectangular	None	COL60X40	Conc Frame	COL60X40
N+6.95	C35	Column	Rectangular	None	COL60X40	Conc Frame	COL60X40
N+6.95	C36	Column	Rectangular	None	COL60X60	Conc Frame	COL60X60
N+3.45	C16	Column	Rectangular	None	COL60X40	Conc Frame	COL60X40
N+3.45	C28	Column	Rectangular	None	COL60X60	Conc Frame	COL60X60
N+3.45	C29	Column	Rectangular	None	COL60X60	Conc Frame	COL60X60
N+3.45	C30	Column	Rectangular	None	COL60X40	Conc Frame	COL60X40
N+3.45	C31	Column	Rectangular	None	COL60X40	Conc Frame	COL60X40
N+3.45	C32	Column	Rectangular	None	COL60X60	Conc Frame	COL60X60
N+3.45	C33	Column	Rectangular	None	COL60X60	Conc Frame	COL60X60
N+3.45	C34	Column	Rectangular	None	COL60X40	Conc Frame	COL60X40
N+3.45	C35	Column	Rectangular	None	COL60X40	Conc Frame	COL60X40
N+3.45	C36	Column	Rectangular	None	COL60X60	Conc Frame	COL60X60
N+9.29	B100	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+9.29	B101	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+9.29	B102	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	B97	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	B98	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	B99	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	B106	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	B107	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	B108	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	B109	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	B110	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	B111	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+6.95	B24	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+6.95	B36	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B37	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45

N+6.95	B38	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B39	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B40	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B41	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B42	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B43	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B44	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B45	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B46	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B47	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B48	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B49	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+6.95	B50	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+6.95	B51	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+6.95	B52	Beam	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+6.95	B54	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+6.95	B55	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+6.95	B56	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B57	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B96	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B103	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+6.95	B104	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+6.95	B105	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+6.95	B112	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+6.95	B113	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+6.95	B114	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+6.95	B115	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+3.45	B24	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B36	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B37	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B38	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B39	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B40	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B41	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B42	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B43	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B44	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B45	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B46	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B47	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B48	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B49	Beam	Rectangular	None	VIG20X45	Conc Frame	VIG20X45
N+3.45	B50	Beam	Rectangular	None	VIG20X45	Conc Frame	VIG20X45
N+3.45	B51	Beam	Rectangular	None	VIG20X45	Conc Frame	VIG20X45
N+3.45	B52	Beam	Rectangular	None	VIG30X45	Conc Frame	VIG30X45
N+3.45	B54	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B55	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B56	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B57	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B58	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B59	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B60	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B61	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B62	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B63	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B64	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B65	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B66	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B67	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B68	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B69	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B70	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B71	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B72	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B73	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+9.29	D100	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+9.29	D112	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+9.29	D117	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+9.29	D122	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	D96	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	D99	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	D113	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	D114	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	D118	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	D119	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	D123	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	D124	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+7.45	D95	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5

N+7.45	D98	Brace	Box/Tube	None	250X150X5	Steel Frame 250X150X5
N+7.45	D110	Brace	Box/Tube	None	250X150X5	Steel Frame 250X150X5
N+7.45	D111	Brace	Box/Tube	None	250X150X5	Steel Frame 250X150X5
N+7.45	D115	Brace	Box/Tube	None	250X150X5	Steel Frame 250X150X5
N+7.45	D116	Brace	Box/Tube	None	250X150X5	Steel Frame 250X150X5
N+7.45	D120	Brace	Box/Tube	None	250X150X5	Steel Frame 250X150X5
N+7.45	D121	Brace	Box/Tube	None	250X150X5	Steel Frame 250X150X5

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D I S T R I B U T E D   L O A D   A S S I G N M E N T S   T O   L I N E   O B J E C T S

LOAD CASE	STORY LEVEL	LINE ID	LOAD TYPE	LOAD DIRECTION	ABSOLUTE DISTANCE A	ABSOLUTE DISTANCE B	LOAD A PER LENGTH	LOAD B PER LENGTH
DEAD	N+3.45	B36	Force	Gravity	0.000	7.900	5.950	5.950
DEAD	N+3.45	B37	Force	Gravity	0.000	7.900	5.950	5.950
DEAD	N+3.45	B38	Force	Gravity	0.000	7.900	5.950	5.950
DEAD	N+3.45	B39	Force	Gravity	0.000	5.300	5.950	5.950
DEAD	N+3.45	B40	Force	Gravity	0.000	7.900	5.950	5.950
DEAD	N+3.45	B41	Force	Gravity	0.000	7.900	5.950	5.950
DEAD	N+3.45	B42	Force	Gravity	0.000	7.800	5.950	5.950
DEAD	N+3.45	B43	Force	Gravity	0.000	5.300	5.950	5.950
DEAD	N+3.45	B44	Force	Gravity	0.000	8.640	5.950	5.950
DEAD	N+3.45	B48	Force	Gravity	0.000	8.640	5.950	5.950
DEAD	N+3.45	B52	Force	Gravity	0.000	5.300	24.000	24.000
LIVE	N+3.45	B52	Force	Gravity	0.000	5.300	13.000	13.000
DEAD	N+9.29	D100	Force	Gravity	0.000	1.440	0.100	0.100
DEAD	N+9.29	D112	Force	Gravity	0.000	1.440	0.200	0.200
DEAD	N+9.29	D117	Force	Gravity	0.000	1.440	0.200	0.200
DEAD	N+9.29	D122	Force	Gravity	0.000	1.440	0.100	0.100
DEAD	N+8.85	D96	Force	Gravity	0.000	4.790	0.100	0.100
DEAD	N+8.85	D99	Force	Gravity	0.000	5.096	0.100	0.100
DEAD	N+8.85	D113	Force	Gravity	0.000	4.790	0.200	0.200
DEAD	N+8.85	D114	Force	Gravity	0.000	5.096	0.200	0.200
DEAD	N+8.85	D118	Force	Gravity	0.000	4.790	0.200	0.200
DEAD	N+8.85	D119	Force	Gravity	0.000	5.096	0.200	0.200
DEAD	N+8.85	D123	Force	Gravity	0.000	4.790	0.100	0.100
DEAD	N+8.85	D124	Force	Gravity	0.000	5.096	0.100	0.100
DEAD	N+7.45	D95	Force	Gravity	0.000	2.076	0.100	0.100
DEAD	N+7.45	D98	Force	Gravity	0.000	2.208	0.100	0.100
DEAD	N+7.45	D110	Force	Gravity	0.000	2.076	0.200	0.200
DEAD	N+7.45	D111	Force	Gravity	0.000	2.208	0.200	0.200
DEAD	N+7.45	D115	Force	Gravity	0.000	2.076	0.200	0.200
DEAD	N+7.45	D116	Force	Gravity	0.000	2.208	0.200	0.200
DEAD	N+7.45	D120	Force	Gravity	0.000	2.076	0.100	0.100
DEAD	N+7.45	D121	Force	Gravity	0.000	2.208	0.100	0.100
LIVE	N+9.29	D100	Force	Gravity	0.000	1.440	0.130	0.130
LIVE	N+9.29	D112	Force	Gravity	0.000	1.440	0.250	0.250
LIVE	N+9.29	D117	Force	Gravity	0.000	1.440	0.250	0.250
LIVE	N+9.29	D122	Force	Gravity	0.000	1.440	0.130	0.130
LIVE	N+8.85	D96	Force	Gravity	0.000	4.790	0.130	0.130
LIVE	N+8.85	D99	Force	Gravity	0.000	5.096	0.130	0.130
LIVE	N+8.85	D113	Force	Gravity	0.000	4.790	0.250	0.250
LIVE	N+8.85	D114	Force	Gravity	0.000	5.096	0.250	0.250
LIVE	N+8.85	D118	Force	Gravity	0.000	4.790	0.250	0.250
LIVE	N+8.85	D119	Force	Gravity	0.000	5.096	0.250	0.250
LIVE	N+8.85	D123	Force	Gravity	0.000	4.790	0.130	0.130
LIVE	N+8.85	D124	Force	Gravity	0.000	5.096	0.130	0.130
LIVE	N+7.45	D95	Force	Gravity	0.000	2.076	0.130	0.130
LIVE	N+7.45	D98	Force	Gravity	0.000	2.208	0.130	0.130
LIVE	N+7.45	D110	Force	Gravity	0.000	2.076	0.250	0.250
LIVE	N+7.45	D111	Force	Gravity	0.000	2.208	0.250	0.250
LIVE	N+7.45	D115	Force	Gravity	0.000	2.076	0.250	0.250
LIVE	N+7.45	D116	Force	Gravity	0.000	2.208	0.250	0.250
LIVE	N+7.45	D120	Force	Gravity	0.000	2.076	0.130	0.130
LIVE	N+7.45	D121	Force	Gravity	0.000	2.208	0.130	0.130
VIENTO	N+9.29	D100	Force	Local-2	0.000	1.440	-1.660	-1.660
VIENTO	N+9.29	D112	Force	Local-2	0.000	1.440	-3.160	-3.160
VIENTO	N+9.29	D117	Force	Local-2	0.000	1.440	-3.160	-3.160
VIENTO	N+9.29	D122	Force	Local-2	0.000	1.440	-1.660	-1.660
VIENTO	N+8.85	D96	Force	Local-2	0.000	4.790	1.660	1.660
VIENTO	N+8.85	D99	Force	Local-2	0.000	5.096	-1.660	-1.660
VIENTO	N+8.85	D113	Force	Local-2	0.000	4.790	3.160	3.160
VIENTO	N+8.85	D114	Force	Local-2	0.000	5.096	-3.160	-3.160
VIENTO	N+8.85	D118	Force	Local-2	0.000	4.790	3.160	3.160
VIENTO	N+8.85	D119	Force	Local-2	0.000	5.096	-3.160	-3.160
VIENTO	N+8.85	D123	Force	Local-2	0.000	4.790	1.660	1.660

VIENTO	N+8.85	D124	Force	Local-2	0.000	3.096	-1.660	-1.660
VIENTO	N+7.45	D85	Force	Local-2	0.000	2.076	1.660	1.660
VIENTO	N+7.45	D88	Force	Local-2	0.000	2.208	-1.660	-1.660
VIENTO	N+7.45	D110	Force	Local-2	0.000	2.076	3.160	3.160
VIENTO	N+7.45	D111	Force	Local-2	0.000	2.208	-3.160	-3.160
VIENTO	N+7.45	D115	Force	Local-2	0.000	2.076	3.160	3.160
VIENTO	N+7.45	D116	Force	Local-2	0.000	2.208	-3.160	-3.160
VIENTO	N+7.45	D120	Force	Local-2	0.000	2.076	1.660	1.660
VIENTO	N+7.45	D121	Force	Local-2	0.000	2.208	-1.660	-1.660

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U N I F O R M L O A D A S S I G N M E N T S T O A R E A O B J E C T S

CASE	STORY	AREA	AREATYPE	DIRECTION	LOAD
DEAD	N+3.45	F1	Floor	Gravity	2.0000
DEAD	N+3.45	F2	Floor	Gravity	2.0000
DEAD	N+3.45	F3	Floor	Gravity	2.0000
DEAD	N+3.45	F4	Floor	Gravity	2.0000
DEAD	N+3.45	F5	Floor	Gravity	2.0000
DEAD	N+3.45	F6	Floor	Gravity	2.0000
DEAD	N+3.45	F7	Floor	Gravity	2.0000
DEAD	N+3.45	F8	Floor	Gravity	2.0000
DEAD	N+3.45	F9	Floor	Gravity	2.0000
DEAD	N+3.45	F10	Floor	Gravity	2.0000
DEAD	N+3.45	F11	Floor	Gravity	2.0000
DEAD	N+3.45	F12	Floor	Gravity	2.0000
DEAD	N+3.45	F13	Floor	Gravity	2.0000
DEAD	N+3.45	F14	Floor	Gravity	2.0000
DEAD	N+3.45	F15	Floor	Gravity	2.0000
DEAD	N+3.45	F16	Floor	Gravity	2.0000
DEAD	N+3.45	F17	Floor	Gravity	5.0000
DEAD	N+3.45	F18	Floor	Gravity	5.0000
DEAD	N+3.45	F19	Floor	Gravity	5.0000
DEAD	N+3.45	F20	Floor	Gravity	5.0000
DEAD	N+3.45	F21	Floor	Gravity	5.0000
DEAD	N+3.45	F22	Floor	Gravity	5.0000
DEAD	N+3.45	F23	Floor	Gravity	5.0000
DEAD	N+3.45	F24	Floor	Gravity	5.0000
LIVE	N+6.95	F25	Floor	Gravity	5.0000
LIVE	N+6.95	F26	Floor	Gravity	5.00000

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S T O R Y D A T A

STORY	SIMILAR TO	HEIGHT	ELEVATION
N+9.29	None	0.500	9.600
N+8.85	None	1.500	9.100
N+7.45	None	0.650	7.600
N+6.95	None	3.500	6.950
N+3.45	None	3.500	3.450
BASE	None		-0.050

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

POINT	X	Y	DZ-BELOW
1	0.000	0.000	0.000
19	0.000	-2.200	0.000
26	0.000	8.640	0.000
27	7.900	8.640	0.000
28	15.800	8.640	0.000
29	23.700	8.640	0.000
30	29.000	8.640	0.000
31	7.900	0.000	0.000
32	15.800	0.000	0.000
33	23.700	0.000	0.000
34	29.000	0.000	0.000
35	7.900	-2.200	0.000
36	15.800	-2.200	0.000
37	23.700	-2.200	0.000
38	29.000	-2.200	0.000
41	3.950	8.640	0.000
42	3.950	0.000	0.000

43	3.950	-2.200	0.000
44	11.850	8.640	0.000
45	11.850	0.000	0.000
46	11.850	-2.200	0.000
47	19.750	8.640	0.000
48	19.750	0.000	0.000
49	19.750	-2.200	0.000
50	26.350	8.640	0.000
51	26.350	0.000	0.000
52	26.350	-2.200	0.000
53	0.000	4.320	0.000
54	3.950	4.320	0.000
55	7.900	4.320	0.000
56	11.850	4.320	0.000
57	15.800	4.320	0.000
58	19.750	4.320	0.000
59	23.700	4.320	0.000
60	26.350	4.320	0.000
61	29.000	4.320	0.000
88	7.900	10.300	0.000
89	15.800	10.300	0.000
90	23.700	10.300	0.000
199	0.000	11.300	0.000
200	0.000	2.970	0.000
203	0.000	-0.229	0.000
204	0.000	9.190	0.000
1-2	0.000	0.000	1.425
26-1	0.000	8.640	1.331
214	7.900	-0.229	0.000
215	7.900	11.300	0.000
216	7.900	9.190	0.000
217	7.900	2.970	0.000
31-2	7.900	0.000	1.425
27-2	7.900	8.640	1.331
218	15.800	-0.229	0.000
219	15.800	11.300	0.000
220	15.800	9.190	0.000
221	15.800	2.970	0.000
32-2	15.800	0.000	1.425
28-2	15.800	8.640	1.331
222	23.700	-0.229	0.000
223	23.700	11.300	0.000
224	23.700	9.190	0.000
225	23.700	2.970	0.000
33-2	23.700	0.000	1.425
29-2	23.700	8.640	1.331
360	0.000	6.755	0.000
360-1	0.000	6.755	0.750
361	7.900	6.755	0.000
361-1	7.900	6.755	0.750
362	15.800	6.755	0.000
362-1	15.800	6.755	0.750
363	23.700	6.755	0.000
363-1	23.700	6.755	0.750
364	0.000	2.046	0.000
364-1	0.000	2.046	0.750
365	7.900	2.046	0.000
365-1	7.900	2.046	0.750
366	15.800	2.046	0.000
366-1	15.800	2.046	0.750
367	23.700	2.046	0.000
367-1	23.700	2.046	0.750

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C O L U M N   C O N N E C T I V I T Y   D A T A

COLUMN	I END PT	J END PT	I END STORY
C16	1	1	Below
C28	34	34	Below
C29	30	30	Below
C30	31	31	Below
C31	32	32	Below
C32	33	33	Below
C33	26	26	Below
C34	27	27	Below
C35	28	28	Below

C36	29	29	Below
C55	53	53	Below
C16-2	1	1-2	Below
C33-1	26	26-1	Below
C60	55	55	Below
C30-2	31	31-2	Below
C34-2	27	27-2	Below
C61	57	57	Below
C35-2	28	28-2	Below
C62	59	59	Below
C32-2	33	33-2	Below
C31-2	32	32-2	Same
C36-1	29	29-2	Below

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B E A M C O N N E C T I V I T Y D A T A

BEAM	I END PT	J END PT
B24	19	1
B36	26	27
B37	27	28
B38	28	29
B39	29	30
B40	1	31
B41	31	32
B42	32	33
B43	33	34
B44	1	26
B45	31	27
B46	32	28
B47	33	29
B48	34	30
B49	19	35
B50	35	36
B51	36	37
B52	37	38
B54	35	31
B55	36	32
B56	37	33
B57	38	34
B58	41	42
B59	42	43
B60	44	45
B61	45	46
B62	47	48
B63	48	49
B64	50	51
B65	51	52
B66	53	54
B67	54	55
B68	55	56
B69	56	57
B70	57	58
B71	58	59
B72	59	60
B73	60	61
B96	59	61
B97	53	55
B98	55	57
B99	57	59
B100	221	225
B101	217	221
B102	200	217
B103	199	215
B104	215	219
B105	219	223
B106	360-1	361-1
B107	361-1	362-1
B108	362-1	363-1
B109	364-1	365-1
B110	365-1	366-1
B111	366-1	367-1
B112	26	199
B113	27	215
B114	28	219
B115	29	223

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B R A C E   C O N N E C T I V I T Y   D A T A

BRACE	I END PT	J END PT	I END STORY
D95	19	203	Below
D96	203	53	Below
D98	199	204	Below
D99	204	53	Below
D100	53	200	Below
D110	35	214	Below
D111	215	216	Below
D112	55	217	Below
D113	214	55	Below
D114	216	55	Below
D115	36	218	Below
D116	219	220	Below
D117	57	221	Below
D118	218	57	Below
D119	220	57	Below
D120	37	222	Below
D121	223	224	Below
D122	58	225	Below
D123	222	58	Below
D124	224	58	Below

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R I G I D   D I A P H R A G M   P O I N T   C O N N E C T I V I T Y   D A T A

STORY	DIAPHRAGM	POINT	POINT	POINT	POINT	POINT
N+6.95	D1	26	27	28	29	30
		1	31	32	33	34
		19	35	36	37	38
		88	89	90	199	53
		215	55	219	57	223
		58	61			
N+3.45	D1	26	27	28	29	30
		1	31	32	33	34
		19	35	36	37	38
		41	42	43	44	45
		46	47	48	49	50
		51	52	53	54	55
		56	57	58	59	60
		61				

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M A T E R I A L   P R O P E R T Y   D A T A

MATERIAL NAME	MATERIAL TYPE	DESIGN TYPE	MATERIAL DIR/PLANE	MODULUS OF ELASTICITY	POISSON'S RATIO	THERMAL COEFF	SHEAR MODULUS
STEEL	Iso	Steel	All	199947978.80	0.3000	1.1700E-05	76903068.77
CONC21	Iso	Concrete	All	21538000.000	0.2000	9.9000E-06	8974166.667
OTHER	Iso	None	All	199947978.80	0.3000	1.1700E-05	76903068.77
A500	Iso	Steel	All	199900000.00	0.3000	1.1700E-05	76884615.38
CUB	Iso	Concrete	All	0.000	0.2000	9.9000E-06	0.000

M A T E R I A L   P R O P E R T Y   M A S S   A N D   W E I G H T

MATERIAL NAME	MASS PER UNIT VOL	WEIGHT PER UNIT VOL
STEEL	7.8271E+00	7.6820E+01
CONC21	2.4000E+00	2.4000E+01
OTHER	7.8271E+00	7.6820E+01
A500	7.8271E+00	7.6820E+01
CUB	2.4000E+00	0.0000E+00

M A T E R I A L   D E S I G N   D A T A   F O R   S T E E L   M A T E R I A L S

MATERIAL NAME	STEEL FY	STEEL FU	STEEL COST ($)
STEEL	344737.894	448159.263	271447.16
A500	352000.000	400000.000	5000.00

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

MATERIAL NAME	LIGHTWEIGHT CONCRETE	CONCRETE FC	REBAR FY	REBAR FYS	LIGHTWT REDUC FACT
CONC21	No	21000.000	420000.000	420000.000	N/A
CUB	No	21000.000	420000.000	420000.000	N/A

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

FRAME SECTION NAME	MATERIAL NAME	SECTION SHAPE NAME OR NAME IN SECTION DATABASE FILE	CONC COL	CONC BEAM
VIG40X45	CONC21	Rectangular		Yes
VIG20X45	CONC21	Rectangular		Yes
COL60X40	CONC21	Rectangular	Yes	
250X150X5	A500	Box/Tube		
PERFILCOL	A500	Box/Tube		
VIG30X45	CONC21	Rectangular		Yes
VIG15X45	CONC21	Rectangular		Yes
COL60X60	CONC21	Rectangular	Yes	

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

FRAME SECTION NAME	SECTION DEPTH	FLANGE WIDTH TOP	FLANGE THICK TOP	WEB THICK	FLANGE WIDTH BOT	FLANGE THICK BOT
VIG40X45	0.4500	0.4000	0.0000	0.0000	0.0000	0.0000
VIG20X45	0.4500	0.2000	0.0000	0.0000	0.0000	0.0000
COL60X40	0.4000	0.6000	0.0000	0.0000	0.0000	0.0000
250X150X5	0.2500	0.1500	0.0050	0.0050	0.0000	0.0000
PERFILCOL	0.1500	0.2500	0.0050	0.0050	0.0000	0.0000
VIG30X45	0.4500	0.3000	0.0000	0.0000	0.0000	0.0000
VIG15X45	0.4500	0.1500	0.0000	0.0000	0.0000	0.0000
COL60X60	0.6000	0.6000	0.0000	0.0000	0.0000	0.0000

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

FRAME SECTION NAME	SECTION AREA	TORSIONAL CONSTANT	MOMENTS OF INERTIA I33	I22	SHEAR AREAS A2	A3
VIG40X45	0.1800	0.0045	0.0030	0.0024	0.1500	0.1500
VIG20X45	0.0900	0.0009	0.0015	0.0003	0.0750	0.0750
COL60X40	0.2400	0.0075	0.0032	0.0072	0.2000	0.2000
250X150X5	0.0039	0.0000	0.0000	0.0000	0.0025	0.0015
PERFILCOL	0.0038	0.0000	0.0000	0.0000	0.0015	0.0025
VIG30X45	0.1350	0.0024	0.0023	0.0010	0.1125	0.1125
VIG15X45	0.0675	0.0004	0.0011	0.0001	0.0563	0.0563
COL60X60	0.3600	0.0183	0.0108	0.0108	0.3000	0.3000

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

FRAME SECTION NAME	SECTION MODULI S33	S22	PLASTIC MODULI Z33	Z22	RADIUS OF GYRATION R33	R22
VIG40X45	0.0135	0.0120	0.0203	0.0180	0.1299	0.1155
VIG20X45	0.0068	0.0030	0.0101	0.0045	0.1299	0.0577
COL60X40	0.0160	0.0240	0.0240	0.0360	0.1155	0.1732
250X150X5	0.0003	0.0002	0.0003	0.0002	0.0934	0.0629
PERFILCOL	0.0002	0.0003	0.0002	0.0003	0.0629	0.0934
VIG30X45	0.0101	0.0068	0.0152	0.0101	0.1299	0.0866
VIG15X45	0.0051	0.0017	0.0076	0.0025	0.1299	0.0433
COL60X60	0.0360	0.0360	0.0540	0.0540	0.1732	0.1732

F R A M E   S E C T I O N   W E I G H T S   A N D   M A S S E S

FRAME SECTION NAME	TOTAL WEIGHT	TOTAL MASS
VIG40X45	1276.3872	127.6387
VIG20X45	51.1920	5.1192
COL60X40	201.6000	20.1600
250X150X5	66.4727	6.7729
PERFILCOL	4.4278	0.4511
VIG30X45	17.1720	1.7172
VIG15X45	8.5860	0.8586
COL60X60	302.4000	30.2400

C O N C R E T E   C O L U M N   D A T A

FRAME SECTION NAME	REINF CONFIGURATION LONGIT	LATERAL	REINF SIZE/TYPE	NUM BARS 3DIR/2DIR	NUM BARS CIRCULAR	BAR COVER
COL60X40	Rectangular	Ties	#9/Design	3/3	N/A	0.0457
COL60X60	Rectangular	Ties	#9/Design	3/3	N/A	0.0457

C O N C R E T E   B E A M   D A T A

FRAME SECTION NAME	TOP COVER	BOT COVER	TOP LEFT AREA	TOP RIGHT AREA	BOT LEFT AREA	BOT RIGHT AREA
VIG40X45	0.0500	0.0500	0.000	0.000	0.000	0.000
VIG20X45	0.0500	0.0500	0.000	0.000	0.000	0.000
VIG30X45	0.0457	0.0457	0.000	0.000	0.000	0.000
VIG15X45	0.0457	0.0457	0.000	0.000	0.000	0.000

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

SHELL SECTION	MATERIAL NAME	SHELL TYPE	LOAD DIST ONE WAY	MEMBRANE THICK	BENDING THICK	TOTAL WEIGHT	TOTAL MASS
CUBLTV	CUB	Membrane	Yes	0.0130	0.0130	0.0000	11.5416
CUBMACSAL2	CONC21	Membrane	No	0.1460	0.1460	1101.5174	110.1517
CUBMACTAN2	CONC21	Membrane	No	0.1960	0.1960	270.2542	27.0254

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

STATIC CASE	CASE TYPE	AUTO LAT LOAD	SELF WT MULTIPLIER	NOTIONAL FACTOR	NOTIONAL DIRECTION
DEAD	DEAD	N/A	1.0000		
LIVE	LIVE	N/A	0.0000		
VIENTO	WIND	None	0.0000		

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R E S P O N S E   S P E C T R U M   C A S E S

RESP SPEC CASE: SISDERX

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0500	0.0000	0.0500

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	DERIVAS	10.1940
U2	-----	N/A

UZ	----	N/A

RESP SPEC CASE: SISDERY

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0500	0.0000	0.0500

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	----	N/A
U2	DERIVAS	11.6690
UZ	----	N/A

RESP SPEC CASE: SISDISX

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0500	0.0000	0.0500

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	DISENO	10.1940
U2	----	N/A
UZ	----	N/A

RESP SPEC CASE: SISDISY

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0500	0.0000	0.0500

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	----	N/A
U2	DISENO	11.6690
UZ	----	N/A

RESP SPEC CASE: SISUMBX

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0200	0.0000	0.0200

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	UMBRAL	11.3800
U2	----	N/A
UZ	----	N/A

COMDIS5	Combo	1.0000
COMDIS6	Combo	1.0000
COMDIS7	Combo	1.0000
COMDIS8	Combo	1.0000
COMDIS9	Combo	1.0000
COMDIS10	Combo	1.0000
COMDIS11	Combo	1.0000

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R E S P O N S E   S P E C T R U M   F U N C T I O N   -   F R O M   F I L E

FUNCTION NAME: DERIVAS

FILE NAME: c:\users\dyein_000\desktop\cristian\maria inmaculada\modelo\bloque c\derivas.txt
DATA TYPE: Period vs Acceleration
NUMBER OF HEADER LINES = 0

PERIOD	ACCEL
0.0000	1.1330
0.0500	1.1330
0.1000	1.1330
0.1600	1.1330
0.2100	1.1330
0.4000	1.1330
0.6000	1.1330
0.8000	1.1330
0.9900	1.1330
1.3400	0.8420
1.6800	0.6690
2.0300	0.5550
2.3700	0.4740
2.7200	0.4140
3.0600	0.3670
3.4100	0.3300
3.7500	0.3000
4.1000	0.2750
4.4400	0.2530
4.7900	0.2350
5.1300	0.2190
5.4800	0.2050
5.8200	0.1930
6.1700	0.1820
6.5100	0.1730
6.8600	0.1640
7.2000	0.1560
8.2000	0.1200
9.2000	0.0960

FUNCTION NAME: DISENO

FILE NAME: c:\users\dyein_000\desktop\cristian\maria inmaculada\modelo\bloque c\diseño.txt
DATA TYPE: Period vs Acceleration
NUMBER OF HEADER LINES = 0

PERIOD	ACCEL
0.0000	0.1618
0.0500	0.1618
0.1000	0.1618
0.1600	0.1618
0.2100	0.1618
0.4000	0.1618
0.6000	0.1618
0.8000	0.1618
0.9900	0.1618
1.3400	0.1201
1.6800	0.0955
2.0300	0.0793
2.3700	0.0677
2.7200	0.0591
3.0600	0.0525
3.4100	0.0472
3.7500	0.0428

4.1000	0.0392
4.4400	0.0362
4.7900	0.0336
5.1300	0.0313
5.4800	0.0293
5.8200	0.0276
6.1700	0.0261
6.5100	0.0247
6.8600	0.0234
7.2000	0.0223
8.2000	0.0172
9.2000	0.0137

FUNCTION NAME: UMBRAL

FILE NAME: c:\users\dyein_000\desktop\cristian\maria inmaculada\modelo\bloque c\umbral.txt
DATA TYPE: Period vs Acceleration
NUMBER OF HEADER LINES = 0

PERIOD	ACCEL
0.0000	0.0900
0.0500	0.1260
0.1000	0.1620
0.1500	0.1980
0.2000	0.2340
0.2500	0.2700
0.4900	0.2700
0.7300	0.2700
0.9800	0.2700
1.2200	0.2700
1.4600	0.2700
1.7000	0.2700
1.9500	0.2700
2.1900	0.2700
2.7800	0.2120
3.3800	0.1750
3.9700	0.1490
4.5600	0.1290
5.1600	0.1150
5.7500	0.1030
6.3400	0.0930
6.9400	0.0850
7.5300	0.0780
8.1300	0.0730
8.7200	0.0680
9.3100	0.0630
9.9100	0.0600
10.5000	0.0560
11.5000	0.0470
12.5000	0.0400

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F R A M E   S E C T I O N   A S S I G N M E N T S   T O   L I N E   O B J E C T S

STORY LEVEL	LINE ID	LINE TYPE	SECTION TYPE	AUTO SELECT SECTION	ANALYSIS SECTION	DESIGN PROCEDURE	DESIGN SECTION
N+8.85	C35	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+8.85	C16-2	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+8.85	C33-1	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+8.85	C60	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+8.85	C30-2	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+8.85	C34-2	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+8.85	C61	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+8.85	C35-2	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+8.85	C62	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+8.85	C32-2	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+8.85	C31-2	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+8.85	C36-1	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+7.45	C16	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+7.45	C30	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+7.45	C32	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+7.45	C33	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+7.45	C34	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL

N+7.45	C35	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+7.45	C36	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+7.45	C55	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+7.45	C60	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+7.45	C61	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+7.45	C62	Column	Box/Tube	None	PERFILCOL	Steel Frame	PERFILCOL
N+6.95	C16	Column	Rectangular	None	COL60X40	Conc Frame	COL60X40
N+6.95	C28	Column	Rectangular	None	COL60X60	Conc Frame	COL60X60
N+6.95	C29	Column	Rectangular	None	COL60X60	Conc Frame	COL60X60
N+6.95	C30	Column	Rectangular	None	COL60X40	Conc Frame	COL60X40
N+6.95	C31	Column	Rectangular	None	COL60X40	Conc Frame	COL60X40
N+6.95	C32	Column	Rectangular	None	COL60X60	Conc Frame	COL60X60
N+6.95	C33	Column	Rectangular	None	COL60X60	Conc Frame	COL60X60
N+6.95	C34	Column	Rectangular	None	COL60X40	Conc Frame	COL60X40
N+6.95	C35	Column	Rectangular	None	COL60X40	Conc Frame	COL60X40
N+6.95	C36	Column	Rectangular	None	COL60X60	Conc Frame	COL60X60
N+3.45	C16	Column	Rectangular	None	COL60X40	Conc Frame	COL60X40
N+3.45	C28	Column	Rectangular	None	COL60X60	Conc Frame	COL60X60
N+3.45	C29	Column	Rectangular	None	COL60X60	Conc Frame	COL60X60
N+3.45	C30	Column	Rectangular	None	COL60X40	Conc Frame	COL60X40
N+3.45	C31	Column	Rectangular	None	COL60X40	Conc Frame	COL60X40
N+3.45	C32	Column	Rectangular	None	COL60X60	Conc Frame	COL60X60
N+3.45	C33	Column	Rectangular	None	COL60X60	Conc Frame	COL60X60
N+3.45	C34	Column	Rectangular	None	COL60X40	Conc Frame	COL60X40
N+3.45	C35	Column	Rectangular	None	COL60X40	Conc Frame	COL60X40
N+3.45	C36	Column	Rectangular	None	COL60X60	Conc Frame	COL60X60
N+8.29	B100	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.29	B101	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.28	B102	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	B97	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	B98	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	B99	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	B106	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	B107	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	B108	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	B109	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	B110	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	B111	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+6.95	B24	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+6.95	B36	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B37	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B38	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B39	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B40	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B41	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B42	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B43	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B44	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B45	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B46	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B47	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B48	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B49	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+6.95	B50	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+6.95	B51	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+6.95	B52	Beam	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+6.95	B54	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+6.95	B55	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+6.95	B56	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B57	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B96	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+6.95	B103	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+6.95	B104	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+6.95	B105	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+6.95	B112	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+6.95	B113	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+6.95	B114	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+6.95	B115	Beam	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+3.45	B24	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B36	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B37	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B38	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B39	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B40	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B41	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B42	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B43	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B44	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45

N+3.45	B45	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B46	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B47	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B48	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B49	Beam	Rectangular	None	VIG20X45	Conc Frame	VIG20X45
N+3.45	B50	Beam	Rectangular	None	VIG20X45	Conc Frame	VIG20X45
N+3.45	B51	Beam	Rectangular	None	VIG20X45	Conc Frame	VIG20X45
N+3.45	B52	Beam	Rectangular	None	VIG30X45	Conc Frame	VIG30X45
N+3.45	B54	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B55	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B56	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B57	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B58	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B59	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B60	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B61	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B62	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B63	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B64	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B65	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B66	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B67	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B68	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B69	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B70	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B71	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B72	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.45	B73	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+9.29	D100	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+9.29	D112	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+9.29	D117	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+9.29	D122	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	D96	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	D99	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	D113	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	D114	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	D118	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	D119	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	D123	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+8.85	D124	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+7.45	D95	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+7.45	D98	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+7.45	D110	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+7.45	D111	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+7.45	D115	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+7.45	D116	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+7.45	D120	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5
N+7.45	D121	Brace	Box/Tube	None	250X150X5	Steel Frame	250X150X5

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D I S T R I B U T E D   L O A D   A S S I G N M E N T S   T O   L I N E   O B J E C T S

LOAD CASE	STORY LEVEL	LINE ID	LOAD TYPE	LOAD DIRECTION	ABSOLUTE DISTANCE A	ABSOLUTE DISTANCE B	LOAD A PER LENGTH	LOAD B PER LENGTH
DEAD	N+3.45	B36	Force	Gravity	0.000	7.900	5.950	5.950
DEAD	N+3.45	B37	Force	Gravity	0.000	7.900	5.950	5.950
DEAD	N+3.45	B38	Force	Gravity	0.000	7.900	5.950	5.950
DEAD	N+3.45	B39	Force	Gravity	0.000	5.300	5.950	5.950
DEAD	N+3.45	B40	Force	Gravity	0.000	7.900	5.950	5.950
DEAD	N+3.45	B41	Force	Gravity	0.000	7.900	5.950	5.950
DEAD	N+3.45	B42	Force	Gravity	0.000	7.900	5.950	5.950
DEAD	N+3.45	B43	Force	Gravity	0.000	5.300	5.950	5.950
DEAD	N+3.45	B44	Force	Gravity	0.000	8.640	5.950	5.950
DEAD	N+3.45	B48	Force	Gravity	0.000	8.640	5.950	5.950
DEAD	N+3.45	B52	Force	Gravity	0.000	5.300	24.000	24.000
LIVE	N+3.45	B52	Force	Gravity	0.000	5.300	13.000	13.000
DEAD	N+9.29	D100	Force	Gravity	0.000	1.440	0.100	0.100
DEAD	N+9.29	D112	Force	Gravity	0.000	1.440	0.200	0.200
DEAD	N+9.29	D117	Force	Gravity	0.000	1.440	0.200	0.200
DEAD	N+9.29	D122	Force	Gravity	0.000	1.440	0.100	0.100
DEAD	N+8.85	D96	Force	Gravity	0.000	4.790	0.100	0.100
DEAD	N+8.85	D99	Force	Gravity	0.000	5.096	0.100	0.100
DEAD	N+8.85	D113	Force	Gravity	0.000	4.790	0.200	0.200
DEAD	N+8.85	D114	Force	Gravity	0.000	5.096	0.200	0.200
DEAD	N+8.85	D118	Force	Gravity	0.000	4.790	0.200	0.200
DEAD	N+8.85	D119	Force	Gravity	0.000	5.096	0.200	0.200

DEAD	N+8.85	D123	Force	Gravity	0.000	4.790	0.100	0.100
DEAD	N+8.85	D124	Force	Gravity	0.000	5.096	0.100	0.100
DEAD	N+7.45	D95	Force	Gravity	0.000	2.076	0.100	0.100
DEAD	N+7.45	D98	Force	Gravity	0.000	2.208	0.100	0.100
DEAD	N+7.45	D110	Force	Gravity	0.000	2.076	0.200	0.200
DEAD	N+7.45	D111	Force	Gravity	0.000	2.208	0.200	0.200
DEAD	N+7.45	D115	Force	Gravity	0.000	2.076	0.200	0.200
DEAD	N+7.45	D116	Force	Gravity	0.000	2.208	0.200	0.200
DEAD	N+7.45	D120	Force	Gravity	0.000	2.076	0.100	0.100
DEAD	N+7.45	D121	Force	Gravity	0.000	2.208	0.100	0.100
LIVE	N+9.29	D100	Force	Gravity	0.000	1.440	0.130	0.130
LIVE	N+9.29	D112	Force	Gravity	0.000	1.440	0.250	0.250
LIVE	N+9.29	D117	Force	Gravity	0.000	1.440	0.250	0.250
LIVE	N+9.29	D122	Force	Gravity	0.000	1.440	0.130	0.130
LIVE	N+8.85	D96	Force	Gravity	0.000	4.790	0.130	0.130
LIVE	N+8.85	D99	Force	Gravity	0.000	5.096	0.130	0.130
LIVE	N+8.85	D113	Force	Gravity	0.000	4.790	0.250	0.250
LIVE	N+8.85	D114	Force	Gravity	0.000	5.096	0.250	0.250
LIVE	N+8.85	D118	Force	Gravity	0.000	4.790	0.250	0.250
LIVE	N+8.85	D119	Force	Gravity	0.000	5.096	0.250	0.250
LIVE	N+8.85	D123	Force	Gravity	0.000	4.790	0.130	0.130
LIVE	N+8.85	D124	Force	Gravity	0.000	5.096	0.130	0.130
LIVE	N+7.45	D95	Force	Gravity	0.000	2.076	0.130	0.130
LIVE	N+7.45	D98	Force	Gravity	0.000	2.208	0.130	0.130
LIVE	N+7.45	D110	Force	Gravity	0.000	2.076	0.250	0.250
LIVE	N+7.45	D111	Force	Gravity	0.000	2.208	0.250	0.250
LIVE	N+7.45	D115	Force	Gravity	0.000	2.076	0.250	0.250
LIVE	N+7.45	D116	Force	Gravity	0.000	2.208	0.250	0.250
LIVE	N+7.45	D120	Force	Gravity	0.000	2.076	0.130	0.130
LIVE	N+7.45	D121	Force	Gravity	0.000	2.208	0.130	0.130
VIENTO	N+9.29	D100	Force	Local-2	0.000	1.440	-1.660	-1.660
VIENTO	N+9.29	D112	Force	Local-2	0.000	1.440	-3.160	-3.160
VIENTO	N+9.29	D117	Force	Local-2	0.000	1.440	-3.160	-3.160
VIENTO	N+9.29	D122	Force	Local-2	0.000	1.440	-1.660	-1.660
VIENTO	N+8.85	D96	Force	Local-2	0.000	4.790	1.660	1.660
VIENTO	N+8.85	D99	Force	Local-2	0.000	5.096	-1.660	-1.660
VIENTO	N+8.85	D113	Force	Local-2	0.000	4.790	3.160	3.160
VIENTO	N+8.85	D114	Force	Local-2	0.000	5.096	-3.160	-3.160
VIENTO	N+8.85	D118	Force	Local-2	0.000	4.790	3.160	3.160
VIENTO	N+8.85	D119	Force	Local-2	0.000	5.096	-3.160	-3.160
VIENTO	N+8.85	D123	Force	Local-2	0.000	4.790	1.660	1.660
VIENTO	N+8.85	D124	Force	Local-2	0.000	5.096	-1.660	-1.660
VIENTO	N+7.45	D95	Force	Local-2	0.000	2.076	1.660	1.660
VIENTO	N+7.45	D98	Force	Local-2	0.000	2.208	-1.660	-1.660
VIENTO	N+7.45	D110	Force	Local-2	0.000	2.076	3.160	3.160
VIENTO	N+7.45	D111	Force	Local-2	0.000	2.208	-3.160	-3.160
VIENTO	N+7.45	D115	Force	Local-2	0.000	2.076	3.160	3.160
VIENTO	N+7.45	D116	Force	Local-2	0.000	2.208	-3.160	-3.160
VIENTO	N+7.45	D120	Force	Local-2	0.000	2.076	1.660	1.660
VIENTO	N+7.45	D121	Force	Local-2	0.000	2.208	-1.660	-1.660

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U N I F O R M   L O A D   A S S I G N M E N T S   T O   A R E A   O B J E C T S

CASE	STORY	AREA	AREATYPE	DIRECTION	LOAD
DEAD	N+3.45	F1	Floor	Gravity	2.0000
DEAD	N+3.45	F2	Floor	Gravity	2.0000
DEAD	N+3.45	F3	Floor	Gravity	2.0000
DEAD	N+3.45	F4	Floor	Gravity	2.0000
DEAD	N+3.45	F5	Floor	Gravity	2.0000
DEAD	N+3.45	F6	Floor	Gravity	2.0000
DEAD	N+3.45	F7	Floor	Gravity	2.0000
DEAD	N+3.45	F8	Floor	Gravity	2.0000
DEAD	N+3.45	F9	Floor	Gravity	2.0000
DEAD	N+3.45	F10	Floor	Gravity	2.0000
DEAD	N+3.45	F11	Floor	Gravity	2.0000
DEAD	N+3.45	F12	Floor	Gravity	2.0000
DEAD	N+3.45	F13	Floor	Gravity	2.0000
DEAD	N+3.45	F14	Floor	Gravity	2.0000
DEAD	N+3.45	F15	Floor	Gravity	2.0000
DEAD	N+3.45	F16	Floor	Gravity	2.0000
DEAD	N+3.45	F17	Floor	Gravity	5.0000
DEAD	N+3.45	F18	Floor	Gravity	5.0000
DEAD	N+3.45	F19	Floor	Gravity	5.0000
DEAD	N+3.45	F20	Floor	Gravity	5.0000
DEAD	N+3.45	F21	Floor	Gravity	5.0000

DEAD	N+3.45	F22	Floor	Gravity	5.0000
DEAD	N+3.45	F23	Floor	Gravity	5.0000
DEAD	N+3.45	F24	Floor	Gravity	5.0000
LIVE	N+6.95	F25	Floor	Gravity	5.0000
LIVE	N+6.95	F26	Floor	Gravity	5.0000

RESP SPEC CASE: SISUMBY

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0200	0.0000	0.0200

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	----	N/A
U2	UMBRAL	13.1590
UZ	----	N/A

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L O A D I N G C O M B I N A T I O N S

COMBO	COMBO TYPE	CASE	CASE TYPE	SCALE FACTOR
CIM1	ADD	DEAD	Static	1.0000
		LIVE	Static	1.0000
COMDIS1	ADD	DEAD	Static	1.4000
COMDIS2	ADD	DEAD	Static	1.2000
		LIVE	Static	1.6000
COMDIS3	ADD	DEAD	Static	1.2000
		LIVE	Static	1.0000
		SISDISX	Spectra	1.0000
		SISDISY	Spectra	0.3000
COMDIS4	ADD	DEAD	Static	1.2000
		LIVE	Static	1.0000
		SISDISX	Spectra	0.3000
		SISDISY	Spectra	1.0000
COMDIS5	ADD	DEAD	Static	0.9000
		SISDISX	Spectra	1.0000
		SISDISY	Spectra	0.3000
COMDIS6	ADD	DEAD	Static	0.9000
		SISDISX	Spectra	0.3000
		SISDISY	Spectra	1.0000
CIM2	ADD	DEAD	Static	1.0000
		LIVE	Static	0.7500
		SISDISX	Spectra	0.5250
		SISDISY	Spectra	0.1575
CIM3	ADD	DEAD	Static	1.0000
		LIVE	Static	0.7500
		SISDISX	Spectra	0.1575
		SISDISY	Spectra	0.5250
COMDER1	ADD	SISDERX	Spectra	1.0000
		SISDERY	Spectra	0.3000
COMDER2	ADD	SISDERX	Spectra	0.3000
		SISDERY	Spectra	1.0000
COMDERRUMB1	ADD	SISUMBX	Spectra	1.0000
		SISUMBY	Spectra	0.3000
COMDERRUMB2	ADD	SISUMBX	Spectra	0.3000
		SISUMBY	Spectra	1.0000
COMDIS7	ADD	DEAD	Static	1.2000
		LIVE	Static	1.6000
		VIENTO	Static	0.8000
COMDIS8	ADD	DEAD	Static	1.2000
		VIENTO	Static	1.6000
		LIVE	Static	1.0000
COMDIS9	ADD	DEAD	Static	0.9000
		VIENTO	Static	1.6000
COMDIS10	ADD	LIVE	Static	1.6000
		DEAD	Static	1.2000
		VIENTO	Static	-0.8000
COMDIS11	ADD	DEAD	Static	0.9000
		VIENTO	Static	-1.6000
ENVOLVENTE	ENVE	COMDIS1	Combo	1.0000
		COMDIS2	Combo	1.0000
		COMDIS3	Combo	1.0000
		COMDIS4	Combo	1.0000

DEAD	N+3.45	F22	Floor	Gravity	5.0000
DEAD	N+3.45	F23	Floor	Gravity	5.0000
DEAD	N+3.45	F24	Floor	Gravity	5.0000
LIVE	N+6.95	F25	Floor	Gravity	5.0000
LIVE	N+6.95	F26	Floor	Gravity	5.0000

9.2 DATOS DE SALIDA

A. Estructuras

FUERZAS EN VIGAS

BEAM FORCES
UNITS: kN-m

Story	Beam	Load	Loc	P	V2	T	M3
N+6.95	B24	ENVOLVENTE MAX	0	0	1,23	0,026	0,669
N+6.95	B24	ENVOLVENTE MAX	1,1	0	1,62	0,026	-0,138
N+6.95	B24	ENVOLVENTE MAX	2,2	0	2,02	0,026	-0,05
N+6.95	B24	ENVOLVENTE MIN	0	0	-0,53	-1,28	-0,565
N+6.95	B24	ENVOLVENTE MIN	1,1	0	-0,23	-1,28	-0,414
N+6.95	B24	ENVOLVENTE MIN	2,2	0	0,07	-1,28	-2,412
N+3.45	B24	ENVOLVENTE MAX	0	0	49,76	-4,322	8,467
N+3.45	B24	ENVOLVENTE MAX	1,1	0	54,61	-4,322	-25,979
N+3.45	B24	ENVOLVENTE MAX	2,2	0	67,47	-4,322	-64,786
N+3.45	B24	ENVOLVENTE MIN	0	0	22,96	-29,868	2,215
N+3.45	B24	ENVOLVENTE MIN	1,1	0	31,67	-29,868	-45,566
N+3.45	B24	ENVOLVENTE MIN	2,2	0	60,78	-29,868	-113,481
N+6.95	B36	ENVOLVENTE MAX	0	0	-7,69	2,437	12,355
N+6.95	B36	ENVOLVENTE MAX	3,95	0	8,05	2,437	15,772
N+6.95	B36	ENVOLVENTE MAX	7,9	0	24,53	2,437	6,645
N+6.95	B36	ENVOLVENTE MIN	0	0	-27,48	-2,676	-58,633
N+6.95	B36	ENVOLVENTE MIN	3,95	0	-7,6	-2,676	6,841
N+6.95	B36	ENVOLVENTE MIN	7,9	0	7,76	-2,676	-58,483
N+3.45	B36	ENVOLVENTE MAX	0	0	-71,02	47,351	-77,693
N+3.45	B36	ENVOLVENTE MAX	3,95	0	-15,19	47,351	112,203
N+3.45	B36	ENVOLVENTE MAX	3,95	0	50,49	-10,748	116,836
N+3.45	B36	ENVOLVENTE MAX	7,9	0	138,76	-10,748	-98,673
N+3.45	B36	ENVOLVENTE MIN	0	0	-126,93	14,267	-200,915
N+3.45	B36	ENVOLVENTE MIN	3,95	0	-64,56	14,267	89,423
N+3.45	B36	ENVOLVENTE MIN	3,95	0	20,21	-28,835	90,6
N+3.45	B36	ENVOLVENTE MIN	7,9	0	76,08	-28,835	-217,328
N+6.95	B37	ENVOLVENTE MAX	0	0	-9,3	3,388	3,901
N+6.95	B37	ENVOLVENTE MAX	3,95	0	6,4	3,388	16,277
N+6.95	B37	ENVOLVENTE MAX	7,9	0	24,88	3,388	1,429
N+6.95	B37	ENVOLVENTE MIN	0	0	-23,69	-1,961	-46,091
N+6.95	B37	ENVOLVENTE MIN	3,95	0	-5,36	-1,961	10,338
N+6.95	B37	ENVOLVENTE MIN	7,9	0	10	-1,961	-51,832
N+3.45	B37	ENVOLVENTE MAX	0	0	-76,32	29,282	-96,021
N+3.45	B37	ENVOLVENTE MAX	3,95	0	-18,69	29,282	138,022
N+3.45	B37	ENVOLVENTE MAX	3,95	0	45,03	-9,208	137,926
N+3.45	B37	ENVOLVENTE MAX	7,9	0	129,63	-9,208	-98,71
N+3.45	B37	ENVOLVENTE MIN	0	0	-129,09	10,787	-202,978
N+3.45	B37	ENVOLVENTE MIN	3,95	0	-64,5	10,787	65,975
N+3.45	B37	ENVOLVENTE MIN	3,95	0	19,67	-29,12	86,148
N+3.45	B37	ENVOLVENTE MIN	7,9	0	75,2	-29,12	-206,176
N+6.95	B38	ENVOLVENTE MAX	0	0	-7,52	5,73	8,276
N+6.95	B38	ENVOLVENTE MAX	3,95	0	8,96	5,73	14,122
N+6.95	B38	ENVOLVENTE MAX	7,9	0	25,44	5,73	3,506
N+6.95	B38	ENVOLVENTE MIN	0	0	-23,26	-1,278	-46,768
N+6.95	B38	ENVOLVENTE MIN	3,95	0	-5,91	-1,278	7,654
N+6.95	B38	ENVOLVENTE MIN	7,9	0	8,45	-1,278	-46,105
N+3.45	B38	ENVOLVENTE MAX	0	0	-73,65	26,972	-96,2
N+3.45	B38	ENVOLVENTE MAX	3,95	0	-17,82	26,972	141,088
N+3.45	B38	ENVOLVENTE MAX	3,95	0	64,76	-6,092	138,649
N+3.45	B38	ENVOLVENTE MAX	7,9	0	127,99	-6,092	-86,938
N+3.45	B38	ENVOLVENTE MIN	0	0	-130,07	9,177	-206,417
N+3.45	B38	ENVOLVENTE MIN	3,95	0	-66,58	9,177	86,607
N+3.45	B38	ENVOLVENTE MIN	3,95	0	16,81	-33,843	85,847
N+3.45	B38	ENVOLVENTE MIN	7,9	0	72,64	-33,843	-206,323
N+6.95	B39	ENVOLVENTE MAX	0	0	-4,88	7,934	36,757
N+6.95	B39	ENVOLVENTE MAX	2,65	0	21,24	7,934	42,425
N+6.95	B39	ENVOLVENTE MAX	5,3	0	71,08	7,934	21,659
N+6.95	B39	ENVOLVENTE MIN	0	0	-66,75	0,015	-85,213
N+6.95	B39	ENVOLVENTE MIN	2,65	0	-16,98	0,015	16,988
N+6.95	B39	ENVOLVENTE MIN	5,3	0	8,28	0,015	-104,772
N+3.45	B39	ENVOLVENTE MAX	0	0	-38,99	28,258	-6,618
N+3.45	B39	ENVOLVENTE MAX	2,65	0	-1,8	28,258	73,508
N+3.45	B39	ENVOLVENTE MAX	2,65	0	51,27	-0,358	65,752
N+3.45	B39	ENVOLVENTE MAX	5,3	0	85,52	-0,358	9,309
N+3.45	B39	ENVOLVENTE MIN	0	0	-104,09	2,252	-152,502
N+3.45	B39	ENVOLVENTE MIN	2,65	0	-59,86	2,252	62,658
N+3.45	B39	ENVOLVENTE MIN	2,65	0	-4,91	-36,532	38,775
N+3.45	B39	ENVOLVENTE MIN	5,3	0	28,88	-36,532	-139,163
N+6.95	B40	ENVOLVENTE MAX	0	0	-9,15	3,229	3,439
N+6.95	B40	ENVOLVENTE MAX	3,95	0	6,21	3,229	11,866
N+6.95	B40	ENVOLVENTE MAX	7,9	0	25,91	3,229	13,597
N+6.95	B40	ENVOLVENTE MIN	0	0	-30,75	-1,937	-72,537
N+6.95	B40	ENVOLVENTE MIN	3,95	0	-10,28	-1,937	6,019
N+6.95	B40	ENVOLVENTE MIN	7,9	0	5,86	-1,937	-50,194
N+3.45	B40	ENVOLVENTE MAX	0	0	-110,26	-6,443	-128,667
N+3.45	B40	ENVOLVENTE MAX	3,95	0	-30,83	-6,443	235,981
N+3.45	B40	ENVOLVENTE MAX	3,95	0	85,69	21,587	245,449
N+3.45	B40	ENVOLVENTE MAX	7,9	0	210,06	21,587	-176,556
N+3.45	B40	ENVOLVENTE MIN	0	0	-186,18	-21,705	-298,119
N+3.45	B40	ENVOLVENTE MIN	3,95	0	-62,91	-21,705	168,95
N+3.45	B40	ENVOLVENTE MIN	3,95	0	82,67	7,746	169,431
N+3.45	B40	ENVOLVENTE MIN	7,9	0	122,69	7,746	-328,06
N+6.95	B41	ENVOLVENTE MAX	0	0	-6,77	3,267	6,626

N+6.95	B41	ENVOLVENTE MAX	3,95	0	4,59	3,267	17,015
N+6.95	B41	ENVOLVENTE MAX	7,9	0	26,73	3,267	7,667
N+6.95	B41	ENVOLVENTE MIN	0	0	-27,58	-2,044	-53,844
N+6.95	B41	ENVOLVENTE MIN	3,95	0	-7,12	-2,044	10,909
N+6.95	B41	ENVOLVENTE MIN	7,9	0	8,56	-2,044	-50,481
N+3.45	B41	ENVOLVENTE MAX	0	0	-119,38	-8,499	-174,269
N+3.45	B41	ENVOLVENTE MAX	3,95	0	-39,75	-8,499	222,016
N+3.45	B41	ENVOLVENTE MAX	3,95	0	16,26	28,92	221,853
N+3.45	B41	ENVOLVENTE MAX	7,9	0	197,41	28,92	-264,611
N+3.45	B41	ENVOLVENTE MIN	0	0	-230,25	-22,189	-323,262
N+3.45	B41	ENVOLVENTE MIN	3,95	0	-76,08	-22,189	136,269
N+3.45	B41	ENVOLVENTE MIN	3,95	0	36,83	8,03	120,388
N+3.45	B41	ENVOLVENTE MIN	7,9	0	116,86	8,03	-312,682
N+6.95	B42	ENVOLVENTE MAX	0	0	-7,17	3,658	9,28
N+6.95	B42	ENVOLVENTE MAX	3,95	0	8,68	3,658	14,652
N+6.95	B42	ENVOLVENTE MAX	7,9	0	29,16	3,658	8,464
N+6.95	B42	ENVOLVENTE MIN	0	0	-27,68	-2,37	-56,037
N+6.95	B42	ENVOLVENTE MIN	3,95	0	-7,28	-2,37	7,371
N+6.95	B42	ENVOLVENTE MIN	7,9	0	7,88	-2,37	-65,725
N+3.45	B42	ENVOLVENTE MAX	0	0	-118,8	-6,316	-167,889
N+3.45	B42	ENVOLVENTE MAX	3,95	0	-38,78	-6,316	229,569
N+3.45	B42	ENVOLVENTE MAX	3,95	0	78,07	29,653	232,765
N+3.45	B42	ENVOLVENTE MAX	7,9	0	200,17	29,653	-156,309
N+3.45	B42	ENVOLVENTE MIN	0	0	-231,91	-18,558	-322,748
N+3.45	B42	ENVOLVENTE MIN	3,95	0	-78,65	-18,558	138,352
N+3.45	B42	ENVOLVENTE MIN	3,95	0	36,96	7,098	140,888
N+3.45	B42	ENVOLVENTE MIN	7,9	0	118,78	7,098	-313,469
N+6.95	B43	ENVOLVENTE MAX	0	0	-10,9	1,505	21,465
N+6.95	B43	ENVOLVENTE MAX	2,65	0	10,56	1,505	62,465
N+6.95	B43	ENVOLVENTE MAX	5,3	0	94,18	1,505	21,862
N+6.95	B43	ENVOLVENTE MIN	0	0	-85,28	-4,866	-123,863
N+6.95	B43	ENVOLVENTE MIN	2,65	0	-20,66	-4,866	21,387
N+6.95	B43	ENVOLVENTE MIN	5,3	0	14,41	-4,866	-122,694
N+3.45	B43	ENVOLVENTE MAX	0	0	-92,68	16,131	-75,581
N+3.45	B43	ENVOLVENTE MAX	2,65	0	-56,39	16,131	165,619
N+3.45	B43	ENVOLVENTE MAX	2,65	0	120,74	12,006	172,705
N+3.45	B43	ENVOLVENTE MAX	5,3	0	182,38	12,006	-62,707
N+3.45	B43	ENVOLVENTE MIN	0	0	-213,1	-5,606	-298,618
N+3.45	B43	ENVOLVENTE MIN	2,65	0	-146,68	-5,606	103,855
N+3.45	B43	ENVOLVENTE MIN	2,65	0	66,25	-17,033	86,958
N+3.45	B43	ENVOLVENTE MIN	5,3	0	78,49	-17,033	-238,669
N+6.95	B44	ENVOLVENTE MAX	0	0	-8,61	3,656	6,356
N+6.95	B44	ENVOLVENTE MAX	4,32	0	6,17	3,656	16,862
N+6.95	B44	ENVOLVENTE MAX	4,32	0	7,95	3,866	17,838
N+6.95	B44	ENVOLVENTE MAX	8,66	0	29,65	3,866	32,588
N+6.95	B44	ENVOLVENTE MIN	0	0	-35,63	-1,817	-47,032
N+6.95	B44	ENVOLVENTE MIN	4,32	0	-13,28	-1,817	6,029
N+6.95	B44	ENVOLVENTE MIN	4,32	0	-16,77	-2,028	4,715
N+6.95	B44	ENVOLVENTE MIN	8,66	0	1,72	-2,028	-61,878
N+3.45	B44	ENVOLVENTE MAX	0	0	-81,65	21,142	-112,794
N+3.45	B44	ENVOLVENTE MAX	4,32	0	-16,58	21,142	143,028
N+3.45	B44	ENVOLVENTE MAX	4,32	0	60,48	-14,19	158,238
N+3.45	B44	ENVOLVENTE MAX	8,66	0	130,47	-14,19	-76,268
N+3.45	B44	ENVOLVENTE MIN	0	0	-144,48	6,006	-261,079
N+3.45	B44	ENVOLVENTE MIN	4,32	0	-51,2	6,006	102,822
N+3.45	B44	ENVOLVENTE MIN	4,32	0	8,36	-32,25	99,066
N+3.45	B44	ENVOLVENTE MIN	8,66	0	72,23	-32,25	-218,874
N+6.95	B45	ENVOLVENTE MAX	0	0	-11,5	3,976	-2,118
N+6.95	B45	ENVOLVENTE MAX	4,32	0	8,18	3,976	28,198
N+6.95	B45	ENVOLVENTE MAX	4,32	0	8,27	3,111	24,532
N+6.95	B45	ENVOLVENTE MAX	8,66	0	41,23	3,111	22,953
N+6.95	B45	ENVOLVENTE MIN	0	0	-38,55	-2,493	-90,15
N+6.95	B45	ENVOLVENTE MIN	4,32	0	-17,18	-2,493	7,406
N+6.95	B45	ENVOLVENTE MIN	4,32	0	-12,1	-4,066	8,787
N+6.95	B45	ENVOLVENTE MIN	8,66	0	5,13	-4,066	-63,032
N+3.45	B45	ENVOLVENTE MAX	0	0	-120,73	5,611	-218,302
N+3.45	B45	ENVOLVENTE MAX	4,32	0	-58,05	5,611	265,127
N+3.45	B45	ENVOLVENTE MAX	4,32	0	83,78	7,566	275,452
N+3.45	B45	ENVOLVENTE MAX	8,66	0	180,28	7,566	-142,76
N+3.45	B45	ENVOLVENTE MIN	0	0	-232,88	-6,037	-364,187
N+3.45	B45	ENVOLVENTE MIN	4,32	0	-136,34	-6,037	141,718
N+3.45	B45	ENVOLVENTE MIN	4,32	0	62,26	-8,561	174,998
N+3.45	B45	ENVOLVENTE MIN	8,66	0	106,95	-8,561	-293,666
N+6.95	B46	ENVOLVENTE MAX	0	0	-21,28	6,309	-2,902
N+6.95	B46	ENVOLVENTE MAX	4,32	0	5,51	6,309	29,697
N+6.95	B46	ENVOLVENTE MAX	4,32	0	8,84	3,355	26,591
N+6.95	B46	ENVOLVENTE MAX	8,66	0	31,06	3,355	31,987
N+6.95	B46	ENVOLVENTE MIN	0	0	-64,32	-2,277	-112,38
N+6.95	B46	ENVOLVENTE MIN	4,32	0	-20,98	-2,277	8,341
N+6.95	B46	ENVOLVENTE MIN	4,32	0	-15,1	-3,554	6,29
N+6.95	B46	ENVOLVENTE MIN	8,66	0	2,91	-3,554	-61,28
N+3.45	B46	ENVOLVENTE MAX	0	0	-117,98	5,865	-198,262
N+3.45	B46	ENVOLVENTE MAX	4,32	0	-55,21	5,865	276,536
N+3.45	B46	ENVOLVENTE MAX	4,32	0	78,11	5,522	267,049
N+3.45	B46	ENVOLVENTE MAX	8,66	0	175,62	5,522	-132,163
N+3.45	B46	ENVOLVENTE MIN	0	0	-230,68	-5,398	-378,787
N+3.45	B46	ENVOLVENTE MIN	4,32	0	-100,14	-5,398	175,688
N+3.45	B46	ENVOLVENTE MIN	4,32	0	36,25	-5,023	160,435
N+3.45	B46	ENVOLVENTE MIN	8,66	0	130,93	-5,023	-366,123
N+6.95	B47	ENVOLVENTE MAX	0	0	-42,98	27,442	-26,198

[illegible]	B47	ENVOLVENTE MAX	4,32	0	4,71	27,402	88,829
N+4.85	B47	ENVOLVENTE MAX	4,32	0	20,25	-6,066	30,858
N+4.85	B47	ENVOLVENTE MAX	8,64	0	92,31	-6,066	33,589
N+4.85	B47	ENVOLVENTE MIN	0	0	-116,85	5,611	-265,152
N+4.85	B47	ENVOLVENTE MIN	4,32	0	-80,99	5,611	36,327
N+4.85	B47	ENVOLVENTE MIN	4,32	0	-13,63	-28,747	31,448
N+4.85	B47	ENVOLVENTE MIN	8,64	0	20,81	-28,747	-161,663
N+3.65	B47	ENVOLVENTE MAX	0	0	-86,63	-1,446	-148,307
N+3.65	B47	ENVOLVENTE MAX	4,32	0	-45,88	-1,446	210,202
N+3.65	B47	ENVOLVENTE MAX	4,32	0	59	20,205	205,528
N+3.65	B47	ENVOLVENTE MAX	8,64	0	165,29	20,205	-75,246
N+3.65	B47	ENVOLVENTE MIN	0	0	-171,31	-20,31	-258,618
N+3.65	B47	ENVOLVENTE MIN	4,32	0	-93,83	-20,31	132,608
N+3.65	B47	ENVOLVENTE MIN	4,32	0	17	3,027	126,288
N+3.65	B47	ENVOLVENTE MIN	8,64	0	76,28	3,027	-288,132
N+4.85	B48	ENVOLVENTE MAX	0	0	-43,7	0,651	-82,828
N+4.85	B48	ENVOLVENTE MAX	4,32	0	-7,15	0,651	170,488
N+4.85	B48	ENVOLVENTE MAX	4,32	0	86,78	18,648	174,192
N+4.85	B48	ENVOLVENTE MAX	8,64	0	123,28	18,648	15,783
N+4.85	B48	ENVOLVENTE MIN	0	0	-152,1	-17,447	-313,374
N+4.85	B48	ENVOLVENTE MIN	4,32	0	-70,06	-17,447	43,459
N+4.85	B48	ENVOLVENTE MIN	4,32	0	-6,71	1,214	-62,661
N+4.85	B48	ENVOLVENTE MIN	8,64	0	29,84	1,218	-213,303
N+3.65	B48	ENVOLVENTE MAX	0	0	-56,83	2,74	-68,695
N+3.65	B48	ENVOLVENTE MAX	4,32	0	0,18	2,76	103,197
N+3.65	B48	ENVOLVENTE MAX	4,32	0	22,86	14,736	103,236
N+3.65	B48	ENVOLVENTE MAX	8,64	0	89,66	14,736	3,961
N+3.65	B48	ENVOLVENTE MIN	0	0	-123,65	-12,199	-276,278
N+3.65	B48	ENVOLVENTE MIN	4,32	0	-44,3	-12,199	61,852
N+3.65	B48	ENVOLVENTE MIN	4,32	0	-14,18	0,744	56,875
N+3.65	B48	ENVOLVENTE MIN	8,64	0	62,58	0,744	-172,659
N+4.85	B49	ENVOLVENTE MAX	0	0	-0,78	0,184	0,169
N+4.85	B49	ENVOLVENTE MAX	4,95	0	0,42	0,184	1,255
N+4.85	B49	ENVOLVENTE MAX	7,9	0	1,77	0,184	-0,78
N+4.85	B49	ENVOLVENTE MIN	0	0	-1,56	-0,088	-0,833
N+4.85	B49	ENVOLVENTE MIN	4,95	0	-0,16	-0,088	0,691
N+4.85	B49	ENVOLVENTE MIN	7,9	0	0,81	-0,064	-2,757
N+3.65	B49	ENVOLVENTE MAX	0	0	-22,86	-2,213	-6,322
N+3.65	B49	ENVOLVENTE MAX	4,95	0	10,63	-2,213	37,822
N+3.65	B49	ENVOLVENTE MAX	4,95	0	2,65	8,158	36,205
N+3.65	B49	ENVOLVENTE MAX	7,9	0	50,21	8,158	-37,62
N+3.65	B49	ENVOLVENTE MIN	0	0	-28,76	-4,467	-26,888
N+3.65	B49	ENVOLVENTE MIN	4,95	0	3,52	-4,467	21,491
N+3.65	B49	ENVOLVENTE MIN	4,95	0	-1,37	4,787	18,615
N+3.65	B49	ENVOLVENTE MIN	7,9	0	40,3	4,787	-68,82
N+4.85	B50	ENVOLVENTE MAX	0	0	-0,88	0,182	-1,228
N+4.85	B50	ENVOLVENTE MAX	4,95	0	0,28	0,182	1,215
N+4.85	B50	ENVOLVENTE MAX	7,9	0	1,42	0,182	-0,896
N+4.85	B50	ENVOLVENTE MIN	0	0	-1,49	-0,121	-2,482
N+4.85	B50	ENVOLVENTE MIN	4,95	0	-0,15	-0,121	0,665
N+4.85	B50	ENVOLVENTE MIN	7,9	0	0,84	-0,121	-2,156
N+3.65	B50	ENVOLVENTE MAX	0	0	-27,67	-6,82	-45,237
N+3.65	B50	ENVOLVENTE MAX	4,95	0	4,8	-6,82	20,035
N+3.65	B50	ENVOLVENTE MAX	4,95	0	-0,8	8,069	20,252
N+3.65	B50	ENVOLVENTE MAX	7,9	0	44,67	8,069	-32,147
N+3.65	B50	ENVOLVENTE MIN	0	0	-65,82	-6,166	-64,082
N+3.65	B50	ENVOLVENTE MIN	4,95	0	0,42	-6,166	9,206
N+3.65	B50	ENVOLVENTE MIN	4,95	0	-6,2	4,566	6,906
N+3.65	B50	ENVOLVENTE MIN	7,9	0	26,06	4,566	-59,467
N+4.85	B51	ENVOLVENTE MAX	0	0	-0,69	0,626	-0,496
N+4.85	B51	ENVOLVENTE MAX	4,95	0	0,52	0,626	0,565
N+4.85	B51	ENVOLVENTE MAX	7,9	0	1,88	0,626	-0,86
N+4.85	B51	ENVOLVENTE MIN	0	0	-1,5	0,021	-2,686
N+4.85	B51	ENVOLVENTE MIN	4,95	0	-0,18	0,021	-0,179
N+4.85	B51	ENVOLVENTE MIN	7,9	0	0,69	0,021	-1,208
N+3.65	B51	ENVOLVENTE MAX	0	0	-27,42	-4,1	-33,916
N+3.65	B51	ENVOLVENTE MAX	4,95	0	5,22	-4,1	21,147
N+3.65	B51	ENVOLVENTE MAX	4,95	0	-2,45	12,329	14,853
N+3.65	B51	ENVOLVENTE MAX	7,9	0	81,08	12,329	-24,757
N+3.65	B51	ENVOLVENTE MIN	0	0	-65,82	-6,848	-82,538
N+3.65	B51	ENVOLVENTE MIN	4,95	0	0,38	-6,848	9,926
N+3.65	B51	ENVOLVENTE MIN	4,95	0	-10,7	6,17	2,275
N+3.65	B51	ENVOLVENTE MIN	7,9	0	23,6	6,17	-51,883
N+4.85	B52	ENVOLVENTE MAX	0	0	-10,55	0,096	-0,458
N+4.85	B52	ENVOLVENTE MAX	2,65	0	3,16	0,096	13,48
N+4.85	B52	ENVOLVENTE MAX	5,3	0	26,86	0,096	-0,838
N+4.85	B52	ENVOLVENTE MIN	0	0	-38,8	-0,522	-28,158
N+4.85	B52	ENVOLVENTE MIN	2,65	0	-2,88	-0,522	11,888
N+4.85	B52	ENVOLVENTE MIN	5,3	0	10,66	-0,522	-27,898
N+3.65	B52	ENVOLVENTE MAX	0	0	-56,91	-5,921	-30,282
N+3.65	B52	ENVOLVENTE MAX	2,65	0	37,54	-5,921	42,862
N+3.65	B52	ENVOLVENTE MAX	2,65	0	-18,27	2,066	66,663
N+3.65	B52	ENVOLVENTE MAX	5,3	0	110,21	2,066	-2,871
N+3.65	B52	ENVOLVENTE MIN	0	0	-122,27	-10,785	-73,418
N+3.65	B52	ENVOLVENTE MIN	2,65	0	12,86	-10,785	10,712
N+3.65	B52	ENVOLVENTE MIN	2,65	0	-49,5	-1,397	13,288
N+3.65	B52	ENVOLVENTE MIN	5,3	0	66,8	-1,397	-66,28
N+4.85	B53	ENVOLVENTE MAX	0	0	1,08	0,604	0,651
N+4.85	B53	ENVOLVENTE MAX	1,1	0	1,88	0,604	-0,163
N+4.85	B53	ENVOLVENTE MAX	2,2	0	1,87	0,604	-0,151

[illegible]	B54	ENVOLVENTE MIN	0	0	-0,98	-0,55	-0,72
N+4.85	B54	ENVOLVENTE MIN	1,1	0	-0,58	-0,55	-1,327
N+4.85	B54	ENVOLVENTE MIN	2,2	0	0,22	-0,55	-2,162
N+3.45	B54	ENVOLVENTE MAX	0	0	88,03	12,07	16,326
N+3.45	B54	ENVOLVENTE MAX	1,1	0	117,09	12,07	-58,798
N+3.45	B54	ENVOLVENTE MAX	2,2	0	188,15	12,07	-146,97
N+3.45	B54	ENVOLVENTE MIN	0	0	58,21	-8,812	8,899
N+3.45	B54	ENVOLVENTE MIN	1,1	0	71,64	-8,812	-98,232
N+3.45	B54	ENVOLVENTE MIN	2,2	0	85,08	-8,812	-242,277
N+4.85	B55	ENVOLVENTE MAX	0	0	0,82	0,586	2,425
N+4.85	B55	ENVOLVENTE MAX	1,1	0	1,19	0,586	-0,118
N+4.85	B55	ENVOLVENTE MAX	2,2	0	1,58	0,586	-0,279
N+4.85	B55	ENVOLVENTE MIN	0	0	-0,64	-0,703	-1,013
N+4.85	B55	ENVOLVENTE MIN	1,1	0	-0,32	-0,703	-1,039
N+4.85	B55	ENVOLVENTE MIN	2,2	0	-0,03	-0,703	-2,816
N+3.45	B55	ENVOLVENTE MAX	0	0	80,49	8,068	16,836
N+3.45	B55	ENVOLVENTE MAX	1,1	0	111,38	8,068	-55,495
N+3.45	B55	ENVOLVENTE MAX	2,2	0	142,91	8,068	-138,507
N+3.45	B55	ENVOLVENTE MIN	0	0	54,51	-14,522	8,861
N+3.45	B55	ENVOLVENTE MIN	1,1	0	68,06	-14,522	-93,587
N+3.45	B55	ENVOLVENTE MIN	2,2	0	81,6	-14,522	-180,477
N+4.85	B56	ENVOLVENTE MAX	0	0	46,41	2,557	6,995
N+4.85	B56	ENVOLVENTE MAX	1,1	0	60,07	2,557	-27,88
N+4.85	B56	ENVOLVENTE MAX	2,2	0	74,33	2,557	-68,18
N+4.85	B56	ENVOLVENTE MIN	0	0	13,45	-22,234	5,187
N+4.85	B56	ENVOLVENTE MIN	1,1	0	20,29	-22,234	-52,537
N+4.85	B56	ENVOLVENTE MIN	2,2	0	27,13	-22,234	-127,823
N+3.45	B56	ENVOLVENTE MAX	0	0	186,23	6,769	21,729
N+3.45	B56	ENVOLVENTE MAX	1,1	0	170,28	6,769	-80,776
N+3.45	B56	ENVOLVENTE MAX	2,2	0	192,33	6,769	-188,404
N+3.45	B56	ENVOLVENTE MIN	0	0	80,73	-33,765	13,487
N+3.45	B56	ENVOLVENTE MIN	1,1	0	94,27	-33,765	-180,542
N+3.45	B56	ENVOLVENTE MIN	2,2	0	107,81	-33,765	-366,438
N+4.85	B57	ENVOLVENTE MAX	0	0	36,86	27,448	2,286
N+4.85	B57	ENVOLVENTE MAX	1,1	0	50,82	27,448	-15,157
N+4.85	B57	ENVOLVENTE MAX	2,2	0	64,78	27,448	-38,681
N+4.85	B57	ENVOLVENTE MIN	0	0	10,86	0,838	-0,522
N+4.85	B57	ENVOLVENTE MIN	1,1	0	17,5	0,838	-87,096
N+4.85	B57	ENVOLVENTE MIN	2,2	0	24,34	0,838	-212,188
N+3.45	B57	ENVOLVENTE MAX	0	0	110,21	66,29	2,088
N+3.45	B57	ENVOLVENTE MAX	1,1	0	122,08	66,29	-53,637
N+3.45	B57	ENVOLVENTE MAX	2,2	0	133,96	66,29	-132,872
N+3.45	B57	ENVOLVENTE MIN	0	0	66,8	2,871	-1,387
N+3.45	B57	ENVOLVENTE MIN	1,1	0	55,71	2,871	-127,075
N+3.45	B57	ENVOLVENTE MIN	2,2	0	64,61	2,871	-268,03
N+3.45	B58	ENVOLVENTE MAX	0	0	-54,46	0,077	-25,77
N+3.45	B58	ENVOLVENTE MAX	4,32	0	11,81	0,077	134,303
N+3.45	B58	ENVOLVENTE MAX	4,32	0	3,12	7,203	84,272
N+3.45	B58	ENVOLVENTE MAX	8,64	0	87,21	7,203	-57,175
N+3.45	B58	ENVOLVENTE MIN	0	0	-86,99	-5,638	-65,82
N+3.45	B58	ENVOLVENTE MIN	4,32	0	8,19	-5,638	64,75
N+3.45	B58	ENVOLVENTE MIN	4,32	0	-3,53	1,893	56,833
N+3.45	B58	ENVOLVENTE MIN	8,64	0	58,18	1,893	-117,088
N+3.45	B59	ENVOLVENTE MAX	0	0	-29,32	0,309	-62,043
N+3.45	B59	ENVOLVENTE MAX	1,1	0	-15,78	0,309	-15,528
N+3.45	B59	ENVOLVENTE MAX	2,2	0	-2,25	0,309	-7,317
N+3.45	B59	ENVOLVENTE MIN	0	0	-32,69	-5,625	-77,828
N+3.45	B59	ENVOLVENTE MIN	1,1	0	-29,63	-5,625	-30,998
N+3.45	B59	ENVOLVENTE MIN	2,2	0	-10,68	-5,625	-12,625
N+3.45	B60	ENVOLVENTE MAX	0	0	-52,08	2,021	-20,799
N+3.45	B60	ENVOLVENTE MAX	4,32	0	18,42	2,021	124,858
N+3.45	B60	ENVOLVENTE MAX	4,32	0	5,53	1,671	95,576
N+3.45	B60	ENVOLVENTE MAX	8,64	0	88,18	1,671	-60,971
N+3.45	B60	ENVOLVENTE MIN	0	0	-85,22	-1,988	-57,628
N+3.45	B60	ENVOLVENTE MIN	4,32	0	3,45	-1,988	64,715
N+3.45	B60	ENVOLVENTE MIN	4,32	0	-2,4	-2,702	58,827
N+3.45	B60	ENVOLVENTE MIN	8,64	0	60,38	-2,702	-123,883
N+3.45	B61	ENVOLVENTE MAX	0	0	-28,78	2,553	-83,308
N+3.45	B61	ENVOLVENTE MAX	1,1	0	-15,22	2,553	-17,828
N+3.45	B61	ENVOLVENTE MAX	2,2	0	-1,68	2,554	-9,827
N+3.45	B61	ENVOLVENTE MIN	0	0	-50,16	-2,613	-80,253
N+3.45	B61	ENVOLVENTE MIN	1,1	0	-28,1	-2,613	-34,021
N+3.45	B61	ENVOLVENTE MIN	2,2	0	-12,58	-2,613	-16,208
N+3.45	B62	ENVOLVENTE MAX	0	0	-21,08	4,758	-17,876
N+3.45	B62	ENVOLVENTE MAX	4,32	0	15,03	4,758	133,445
N+3.45	B62	ENVOLVENTE MAX	4,32	0	6,88	0,215	90,81
N+3.45	B62	ENVOLVENTE MAX	8,64	0	88,98	0,215	-92,287
N+3.45	B62	ENVOLVENTE MIN	0	0	-86,38	-0,502	-80,21
N+3.45	B62	ENVOLVENTE MIN	4,32	0	5,27	-0,502	61,898
N+3.45	B62	ENVOLVENTE MIN	4,32	0	-2,01	-5,998	51,281
N+3.45	B62	ENVOLVENTE MIN	8,64	0	60,17	-5,998	-186,075
N+3.45	B63	ENVOLVENTE MAX	0	0	-30,48	-1,208	-87,671
N+3.45	B63	ENVOLVENTE MAX	1,1	0	-14,81	-1,208	-20,032
N+3.45	B63	ENVOLVENTE MAX	2,2	0	-3,27	-1,208	-10,6
N+3.45	B63	ENVOLVENTE MIN	0	0	-53,75	-11,185	-80,878
N+3.45	B63	ENVOLVENTE MIN	1,1	0	-33,33	-11,185	-82,022
N+3.45	B63	ENVOLVENTE MIN	2,2	0	-13,28	-11,185	-17,607
N+3.45	B64	ENVOLVENTE MAX	0	0	-61,78	8,778	-2,798
N+3.45	B64	ENVOLVENTE MAX	4,32	0	18,64	8,778	80,208
N+3.45	B64	ENVOLVENTE MAX	4,32	0	21,84	-2,005	80,758

[illegible]	B64	ENVOLVENTE MAX	8,64	0	108,73	-2,005	-90,998
N+3.45	B64	ENVOLVENTE MIN	0	0	-74,25	1,852	-64,601
N+3.45	B64	ENVOLVENTE MIN	4,32	0	3,67	1,852	84,765
N+3.45	B64	ENVOLVENTE MIN	4,32	0	3,99	-10,753	87,724
N+3.45	B64	ENVOLVENTE MIN	8,64	0	42,1	-10,753	-230,26
N+3.45	B65	ENVOLVENTE MAX	0	0	-60,29	8,93	-110,015
N+3.45	B65	ENVOLVENTE MAX	1,1	0	-26,76	8,93	-49,407
N+3.45	B65	ENVOLVENTE MAX	2,2	0	-13,22	8,93	-6,228
N+3.45	B65	ENVOLVENTE MIN	0	0	-127,8	-1,875	-196,709
N+3.45	B65	ENVOLVENTE MIN	1,1	0	-104,75	-1,875	-109,295
N+3.45	B65	ENVOLVENTE MIN	2,2	0	-86,7	-1,875	-11,742
N+3.45	B66	ENVOLVENTE MAX	0	0	-49,58	7,309	-21,108
N+3.45	B66	ENVOLVENTE MAX	1,975	0	-22,58	7,309	76,63
N+3.45	B66	ENVOLVENTE MAX	3,95	0	5,32	7,309	99,982
N+3.45	B66	ENVOLVENTE MIN	0	0	-78,76	-0,231	-52,262
N+3.45	B66	ENVOLVENTE MIN	1,975	0	-37,76	-0,231	82,344
N+3.45	B66	ENVOLVENTE MIN	3,95	0	1,27	-0,231	80,208
N+3.45	B67	ENVOLVENTE MAX	0	0	15,07	-1,569	80,889
N+3.45	B67	ENVOLVENTE MAX	1,975	0	57,07	-1,569	29,182
N+3.45	B67	ENVOLVENTE MAX	3,95	0	99,07	-1,569	-40,697
N+3.45	B67	ENVOLVENTE MIN	0	0	8,22	-7,936	57,278
N+3.45	B67	ENVOLVENTE MIN	1,975	0	35,22	-7,936	15,514
N+3.45	B67	ENVOLVENTE MIN	3,95	0	62,24	-7,936	-146,865
N+3.45	B68	ENVOLVENTE MAX	0	0	-57,14	5,835	-80,516
N+3.45	B68	ENVOLVENTE MAX	1,975	0	-30,14	5,835	15,13
N+3.45	B68	ENVOLVENTE MAX	3,95	0	-3,13	5,835	57,871
N+3.45	B68	ENVOLVENTE MIN	0	0	-90,08	-0,023	-131,88
N+3.45	B68	ENVOLVENTE MIN	1,975	0	-49,08	-0,023	9,324
N+3.45	B68	ENVOLVENTE MIN	3,95	0	-9,08	-0,023	35,885
N+3.45	B69	ENVOLVENTE MAX	0	0	6,78	0,127	50,582
N+3.45	B69	ENVOLVENTE MAX	1,975	0	46,78	0,127	16,31
N+3.45	B69	ENVOLVENTE MAX	3,95	0	86,79	0,127	-76,873
N+3.45	B69	ENVOLVENTE MIN	0	0	2,46	-7,069	35,678
N+3.45	B69	ENVOLVENTE MIN	1,975	0	29,46	-7,069	8,163
N+3.45	B69	ENVOLVENTE MIN	3,95	0	56,46	-7,069	-126,256
N+3.45	B70	ENVOLVENTE MAX	0	0	-58,17	6,605	-75,38
N+3.45	B70	ENVOLVENTE MAX	1,975	0	-31,17	6,605	28,858
N+3.45	B70	ENVOLVENTE MAX	3,95	0	-4,17	6,605	72,976
N+3.45	B70	ENVOLVENTE MIN	0	0	-92,67	0,239	-126,963
N+3.45	B70	ENVOLVENTE MIN	1,975	0	-50,67	0,239	12,621
N+3.45	B70	ENVOLVENTE MIN	3,95	0	-8,48	0,239	45,668
N+3.45	B71	ENVOLVENTE MAX	0	0	2,98	0,913	79,19
N+3.45	B71	ENVOLVENTE MAX	1,975	0	44,2	0,913	44,258
N+3.45	B71	ENVOLVENTE MAX	3,95	0	86,2	0,913	-56,107
N+3.45	B71	ENVOLVENTE MIN	0	0	0,8	-9,444	47,818
N+3.45	B71	ENVOLVENTE MIN	1,975	0	27,8	-9,444	23,628
N+3.45	B71	ENVOLVENTE MIN	3,95	0	54,8	-9,444	-95,435
N+3.45	B72	ENVOLVENTE MAX	0	0	-26,9	2,928	-38,68
N+3.45	B72	ENVOLVENTE MAX	1,325	0	-12,75	2,928	-8,155
N+3.45	B72	ENVOLVENTE MAX	2,65	0	2,98	2,928	3,28
N+3.45	B72	ENVOLVENTE MIN	0	0	-45,61	-3,998	-66,387
N+3.45	B72	ENVOLVENTE MIN	1,325	0	-24,27	-3,998	-21,098
N+3.45	B72	ENVOLVENTE MIN	2,65	0	-4,08	-3,998	-9,588
N+3.45	B73	ENVOLVENTE MAX	0	0	-3,37	5,853	13,558
N+3.45	B73	ENVOLVENTE MAX	1,325	0	11,8	5,853	18,713
N+3.45	B73	ENVOLVENTE MAX	2,65	0	26,15	5,853	3,807
N+3.45	B73	ENVOLVENTE MIN	0	0	-13,51	-5,771	2,408
N+3.45	B73	ENVOLVENTE MIN	1,325	0	6,66	-5,771	1,881
N+3.45	B73	ENVOLVENTE MIN	2,65	0	16,28	-5,771	-23,848
N+6.95	B96	ENVOLVENTE MAX	0	0	-37,11	1,287	-31,198
N+6.95	B96	ENVOLVENTE MAX	2,65	0	1,91	1,287	110,162
N+6.95	B96	ENVOLVENTE MAX	5,3	0	99,62	1,287	-1,781
N+6.95	B96	ENVOLVENTE MIN	0	0	-116,07	-2,921	-87,205
N+6.95	B96	ENVOLVENTE MIN	2,65	0	-9,58	-2,921	88,206
N+6.95	B96	ENVOLVENTE MIN	5,3	0	52,48	-2,921	-35,236
N+6.95	B103	ENVOLVENTE MAX	0	0	-0,74	0,289	3,407
N+6.95	B103	ENVOLVENTE MAX	3,95	0	0,37	0,289	1,623
N+6.95	B103	ENVOLVENTE MAX	7,9	0	1,65	0,289	-0,957
N+6.95	B103	ENVOLVENTE MIN	0	0	-1,66	-0,145	-1,665
N+6.95	B103	ENVOLVENTE MIN	3,95	0	-0,07	-0,145	0,95
N+6.95	B103	ENVOLVENTE MIN	7,9	0	0,99	-0,145	-2,456
N+6.95	B104	ENVOLVENTE MAX	0	0	-0,95	0,145	-1,077
N+6.95	B104	ENVOLVENTE MAX	3,95	0	0,16	0,145	0,800
N+6.95	B104	ENVOLVENTE MAX	7,9	0	1,12	0,145	-1,381
N+6.95	B104	ENVOLVENTE MIN	0	0	-1,59	-0,124	-0,132
N+6.95	B104	ENVOLVENTE MIN	3,95	0	-0,08	-0,124	0,55
N+6.95	B104	ENVOLVENTE MIN	7,9	0	1,03	-0,124	-2,762
N+6.95	B105	ENVOLVENTE MAX	0	0	-1,05	0,305	-1,288
N+6.95	B105	ENVOLVENTE MAX	3,95	0	0,01	0,305	1,86
N+6.95	B105	ENVOLVENTE MAX	7,9	0	1,4	0,305	0,248
N+6.95	B105	ENVOLVENTE MIN	0	0	-1,92	-0,466	-3,283
N+6.95	B105	ENVOLVENTE MIN	3,95	0	-0,45	-0,466	3,853
N+6.95	B105	ENVOLVENTE MIN	7,9	0	0,72	-0,466	-1,437
N+6.95	B112	ENVOLVENTE MAX	0	0	-0,52	0,888	-0,862
N+6.95	B112	ENVOLVENTE MAX	1,22	0	-0,16	0,888	-0,275
N+6.95	B112	ENVOLVENTE MAX	2,44	0	0,2	0,888	1,986
N+6.95	B112	ENVOLVENTE MIN	0	0	-3,16	-0,164	-5,257
N+6.95	B112	ENVOLVENTE MIN	1,22	0	-2,68	-0,164	-1,508
N+6.95	B112	ENVOLVENTE MIN	2,44	0	-2,2	-0,164	-0,507
N+6.95	B113	ENVOLVENTE MAX	0	0	-0,2	0,289	-0,687

N+4.95	B113	ENVOLVENTE MAX	1,33	0	0,15	0,289	-0,596
N+4.95	B113	ENVOLVENTE MAX	1,66	0	0,28	0,289	-0,182
N+4.95	B113	ENVOLVENTE MAX	1,66	0	0,28	0,289	-0,182
N+4.95	B113	ENVOLVENTE MAX	2,66	0	0,51	0,289	2,76
N+4.95	B113	ENVOLVENTE MIN	0	0	-3,88	-0,542	-4,332
N+4.95	B113	ENVOLVENTE MIN	1,33	0	-3,4	-0,542	-1,502
N+4.95	B113	ENVOLVENTE MIN	1,66	0	-3,28	-0,542	-0,782
N+4.95	B113	ENVOLVENTE MIN	1,66	0	-3,28	-0,542	-0,782
N+4.95	B113	ENVOLVENTE MIN	2,66	0	-2,92	-0,542	-1,299
N+4.95	B114	ENVOLVENTE MAX	0	0	-0,42	0,528	-1,166
N+4.95	B114	ENVOLVENTE MAX	1,33	0	-0,06	0,528	-0,767
N+4.95	B114	ENVOLVENTE MAX	1,66	0	0,23	0,528	-0,28
N+4.95	B114	ENVOLVENTE MAX	1,66	0	0,23	0,528	-0,28
N+4.95	B114	ENVOLVENTE MAX	2,66	0	0,8	0,528	2,779
N+4.95	B114	ENVOLVENTE MIN	0	0	-4,13	-0,214	-6,882
N+4.95	B114	ENVOLVENTE MIN	1,33	0	-3,67	-0,214	-1,885
N+4.95	B114	ENVOLVENTE MIN	1,66	0	-3,55	-0,214	-1,091
N+4.95	B114	ENVOLVENTE MIN	1,66	0	-3,55	-0,214	-1,091
N+4.95	B114	ENVOLVENTE MIN	2,66	0	-3,18	-0,214	-1,009
N+4.95	B115	ENVOLVENTE MAX	0	0	-2,97	0,112	-5,973
N+4.95	B115	ENVOLVENTE MAX	1,33	0	-2,61	0,112	-2,159
N+4.95	B115	ENVOLVENTE MAX	1,66	0	-2,52	0,112	-1,21
N+4.95	B115	ENVOLVENTE MAX	1,66	0	-2,52	0,112	-1,21
N+4.95	B115	ENVOLVENTE MAX	2,66	0	-2,25	0,112	3,799
N+4.95	B115	ENVOLVENTE MIN	0	0	-10,44	-0,748	-20,688
N+4.95	B115	ENVOLVENTE MIN	1,33	0	-9,96	-0,748	-7,127
N+4.95	B115	ENVOLVENTE MIN	1,66	0	-9,84	-0,748	-3,88
N+4.95	B115	ENVOLVENTE MIN	1,66	0	-9,84	-0,748	-3,88
N+4.95	B115	ENVOLVENTE MIN	2,66	0	-9,48	-0,748	1,073

FUERZAS EN COLUMNAS

COLUMN FORCES
UNIT: kN-m

Story	Column	Load	Loc	P	V2	V3	T	M2	M3
N+4.95	C16	ENVOLVENTE MAX	0,000	-69,200	-19,450	-0,780	4,110	-15,406	-66,365
N+4.95	C16	ENVOLVENTE MAX	1,750	-65,130	-19,450	-0,780	4,110	-0,516	-25,727
N+4.95	C16	ENVOLVENTE MAX	3,500	-61,060	-19,450	-0,780	4,110	64,230	76,826
N+4.95	C16	ENVOLVENTE MIN	0,000	-96,060	-64,450	-52,090	-6,622	-102,574	-148,006
N+4.95	C16	ENVOLVENTE MIN	1,750	-83,690	-64,450	-52,090	-6,622	-23,916	-45,875
N+4.95	C16	ENVOLVENTE MIN	3,500	-71,090	-64,350	-52,090	-6,622	-14,610	3,512
N+1.45	C16	ENVOLVENTE MAX	0,000	-305,860	-14,510	14,750	2,954	67,748	16,402
N+1.45	C16	ENVOLVENTE MAX	1,750	-299,780	-14,510	14,750	2,954	82,827	69,580
N+1.45	C16	ENVOLVENTE MAX	3,500	-290,710	-14,510	14,750	2,954	100,586	160,590
N+1.45	C16	ENVOLVENTE MIN	0,000	-522,410	-63,440	-63,720	-4,085	-185,041	-131,251
N+1.45	C16	ENVOLVENTE MIN	1,750	-508,400	-63,440	-63,720	-4,085	-69,558	8,843
N+1.45	C16	ENVOLVENTE MIN	3,500	-494,180	-63,440	-63,720	-4,085	13,666	67,004
N+4.95	C28	ENVOLVENTE MAX	0,000	-125,660	14,930	-2,540	10,038	-38,705	83,960
N+4.95	C28	ENVOLVENTE MAX	1,750	-112,050	14,930	-2,540	10,038	12,173	64,177
N+4.95	C28	ENVOLVENTE MAX	3,500	-98,440	14,930	-2,540	10,038	147,458	224,006
N+4.95	C28	ENVOLVENTE MIN	0,000	-341,880	-99,400	-80,210	-16,287	-150,712	-128,247
N+4.95	C28	ENVOLVENTE MIN	1,750	-323,730	-99,400	-80,210	-16,287	-28,115	10,725
N+4.95	C28	ENVOLVENTE MIN	3,500	-305,580	-99,400	-80,210	-16,287	-21,919	-6,022
N+1.45	C28	ENVOLVENTE MAX	0,000	-375,380	81,540	86,630	7,176	169,380	192,458
N+1.45	C28	ENVOLVENTE MAX	1,750	-361,770	81,540	86,630	7,176	97,948	66,450
N+1.45	C28	ENVOLVENTE MAX	3,500	-348,160	81,540	86,630	7,176	134,037	4,611
N+1.45	C28	ENVOLVENTE MIN	0,000	-781,120	-91,180	-109,130	-6,828	-229,630	-241,239
N+1.45	C28	ENVOLVENTE MIN	1,750	-762,960	-91,180	-109,130	-6,828	-48,009	-200,142
N+1.45	C28	ENVOLVENTE MIN	3,500	-744,820	-91,180	-109,130	-6,828	8,450	-119,453
N+4.95	C29	ENVOLVENTE MAX	0,000	-78,970	88,240	3,020	10,038	-6,490	136,167
N+4.95	C29	ENVOLVENTE MAX	1,750	-66,360	88,240	3,020	10,038	20,844	0,580
N+4.95	C29	ENVOLVENTE MAX	3,500	-52,750	88,240	3,020	10,038	172,422	20,886
N+4.95	C29	ENVOLVENTE MIN	0,000	-223,560	-15,180	-60,060	-16,287	-89,633	-30,136
N+4.95	C29	ENVOLVENTE MIN	1,750	-205,420	-15,180	-60,060	-16,287	-17,810	-52,700
N+4.95	C29	ENVOLVENTE MIN	3,500	-187,280	-15,180	-60,060	-16,287	-20,230	-213,658
N+1.45	C29	ENVOLVENTE MAX	0,000	-198,660	79,410	69,960	7,176	151,306	221,600
N+1.45	C29	ENVOLVENTE MAX	1,750	-181,060	79,410	69,960	7,176	64,867	63,477
N+1.45	C29	ENVOLVENTE MAX	3,500	-167,450	79,410	69,960	7,176	74,669	-19,075
N+1.45	C29	ENVOLVENTE MIN	0,000	-427,520	-83,500	-74,380	-6,828	-167,603	-455,142
N+1.45	C29	ENVOLVENTE MIN	1,750	-409,370	-83,500	-74,380	-6,828	-58,196	-192,270
N+1.45	C29	ENVOLVENTE MIN	3,500	-391,210	-83,500	-74,380	-6,828	-25,250	-65,130
N+4.95	C30	ENVOLVENTE MAX	0,000	-64,240	28,520	-6,520	4,110	-15,880	32,634
N+4.95	C30	ENVOLVENTE MAX	1,750	-55,170	28,520	-6,520	4,110	-5,431	8,648
N+4.95	C30	ENVOLVENTE MAX	3,500	-46,100	28,520	-6,520	4,110	84,381	61,057
N+4.95	C30	ENVOLVENTE MIN	0,000	-122,570	-40,250	-61,830	-6,622	-126,160	-84,863
N+4.95	C30	ENVOLVENTE MIN	1,750	-108,460	-40,250	-61,830	-6,622	-24,711	0,880
N+4.95	C30	ENVOLVENTE MIN	3,500	-95,020	-40,250	-61,830	-6,622	-4,305	-49,203
N+1.45	C30	ENVOLVENTE MAX	0,000	-555,210	37,540	6,700	2,954	68,106	75,374
N+1.45	C30	ENVOLVENTE MAX	1,750	-546,150	37,540	6,700	2,954	27,157	10,748
N+1.45	C30	ENVOLVENTE MAX	3,500	-537,080	37,540	6,700	2,954	123,746	36,670
N+1.45	C30	ENVOLVENTE MIN	0,000	-912,280	-30,280	-65,560	-4,085	-197,412	-69,812
N+1.45	C30	ENVOLVENTE MIN	1,750	-888,980	-30,280	-65,560	-4,085	-68,865	-17,968
N+1.45	C30	ENVOLVENTE MIN	3,500	-874,870	-30,280	-65,560	-4,085	21,552	-36,183
N+4.95	C31	ENVOLVENTE MAX	0,000	-65,840	26,520	-5,540	4,110	-23,700	41,969
N+4.95	C31	ENVOLVENTE MAX	1,750	-56,770	26,520	-5,540	4,110	-7,859	1,965
N+4.95	C31	ENVOLVENTE MAX	3,500	-47,700	26,520	-5,540	4,110	106,346	57,651

[illegible]	[illegible]	ENVOLVENTE MIN	0	-126,08	-32,88	-71,81	-6,622	-162,271	-56,289
N+6.85	C31	ENVOLVENTE MIN	1,750	-112,170	-32,630	-71,410	-6,622	-33,497	-5,607
N+6.85	C31	ENVOLVENTE MIN	3,5	-100,08	-32,88	-71,81	-6,622	-4,976	-50,995
N+3.45	C31	ENVOLVENTE MAX	0	-541,76	31,71	5,48	2,954	46,567	89,328
N+3.45	C31	ENVOLVENTE MAX	1,750	-532,670	31,710	5,480	2,954	37,569	14,934
N+3.45	C31	ENVOLVENTE MAX	3,5	-523,600	31,710	5,480	2,954	85,331	51,177
N+3.45	C31	ENVOLVENTE MIN	0	-886,860	-36,940	-66,710	-4,065	-210,234	-78,135
N+3.45	C31	ENVOLVENTE MIN	1,75	-873,760	-36,940	-66,710	-4,065	-59,118	-13,812
N+3.45	C31	ENVOLVENTE MIN	3,5	-858,680	-36,940	-66,710	-4,065	25,265	-41,752
N+6.85	C32	ENVOLVENTE MAX	0	-147,080	23,990	69,160	10,033	72,384	89,455
N+6.85	C32	ENVOLVENTE MAX	1,75	-133,880	23,990	69,160	10,033	-2,875	20,510
N+6.85	C32	ENVOLVENTE MAX	3,5	-119,870	23,990	69,160	10,033	72,836	117,227
N+6.85	C32	ENVOLVENTE MIN	0	-394,320	-59,080	-63,640	-14,087	-81,256	-98,926
N+6.85	C32	ENVOLVENTE MIN	1,75	-386,170	-59,080	-63,640	-14,087	-51,177	-6,280
N+6.85	C32	ENVOLVENTE MIN	3,5	-368,030	-59,080	-63,640	-14,087	-170,387	-41,986
N+3.45	C32	ENVOLVENTE MAX	0	-619,800	57,070	66,900	7,176	192,870	147,287
N+3.45	C32	ENVOLVENTE MAX	1,75	-605,7	57,07	66,9	7,176	80,87	56,455
N+3.45	C32	ENVOLVENTE MAX	3,5	-590,08	57,07	66,9	7,176	129,013	26,165
N+3.45	C32	ENVOLVENTE MIN	0	-1118,33	-66,43	-99	-9,828	-219,469	-306,336
N+3.45	C32	ENVOLVENTE MIN	1,75	-1101,19	-66,43	-99	-9,828	-51,068	-166,236
N+3.45	C32	ENVOLVENTE MIN	3,5	-1088,24	-66,43	-99	-9,828	-82,932	-60,643
N+6.85	C33	ENVOLVENTE MAX	0	-47,82	51,7	65,06	10,033	107,189	129,95
N+6.85	C33	ENVOLVENTE MAX	1,75	-34,81	51,7	65,06	10,033	42,006	59,667
N+6.85	C33	ENVOLVENTE MAX	3,5	-20,21	51,7	65,06	10,033	11,306	67,614
N+6.85	C33	ENVOLVENTE MIN	0	-100,37	-6,5	10,97	-14,087	42,086	27,065
N+6.85	C33	ENVOLVENTE MIN	1,75	-82,24	-6,5	10,97	-14,087	9,217	15,972
N+6.85	C33	ENVOLVENTE MIN	3,5	-64,08	-6,5	10,97	-14,087	-58,163	-55,771
N+3.45	C33	ENVOLVENTE MAX	0	-221,91	89,13	87,94	7,176	221,427	166,298
N+3.45	C33	ENVOLVENTE MAX	1,75	-208,3	89,13	87,94	7,176	50,198	26,655
N+3.45	C33	ENVOLVENTE MAX	3,5	-198,68	89,13	87,94	7,176	-32,358	-38,083
N+3.45	C33	ENVOLVENTE MIN	0	-398,1	-61,32	-27,88	-9,828	-132,277	-195,276
N+3.45	C33	ENVOLVENTE MIN	1,75	-376,94	-61,32	-27,88	-9,828	-90,4	-132,105
N+3.45	C33	ENVOLVENTE MIN	3,5	-355,76	-61,32	-27,88	-9,828	-183,318	-150,837
N+6.85	C34	ENVOLVENTE MAX	0	-49,7	27,93	61,53	4,13	164,092	86,967
N+6.85	C34	ENVOLVENTE MAX	1,75	-40,63	27,93	61,53	4,13	59,366	5,486
N+6.85	C34	ENVOLVENTE MAX	3,5	-31,56	27,93	61,53	4,13	34,05	63,983
N+6.85	C34	ENVOLVENTE MIN	0	-132,92	-22,08	8,15	-6,622	61,358	-38,821
N+6.85	C34	ENVOLVENTE MIN	1,75	-110,82	-22,08	8,15	-6,622	86,873	-2,633
N+6.85	C34	ENVOLVENTE MIN	3,5	-98,74	-22,08	8,15	-6,622	-52,192	-50,826
N+3.45	C34	ENVOLVENTE MAX	0	-351,43	30,6	94,16	2,954	135,249	86,262
N+3.45	C34	ENVOLVENTE MAX	1,75	-342,35	30,6	94,16	2,954	-8,839	12,609
N+3.45	C34	ENVOLVENTE MAX	3,5	-332,38	30,6	94,16	2,954	-96,86	42,771
N+3.45	C34	ENVOLVENTE MIN	0	-585,41	-25,92	2,16	-4,065	-89,217	-56,023
N+3.45	C34	ENVOLVENTE MIN	1,75	-571,3	-25,92	2,16	-4,065	-113,751	-12,77
N+3.45	C34	ENVOLVENTE MIN	3,5	-557,19	-25,92	2,16	-4,065	-198,960	-41,114
N+6.85	C35	ENVOLVENTE MAX	0	-48,13	27,04	56,75	4,13	157,041	82,863
N+6.85	C35	ENVOLVENTE MAX	1,75	-39,06	27,04	56,75	4,13	66,492	2,988
N+6.85	C35	ENVOLVENTE MAX	3,5	-29,98	27,04	56,75	4,13	27,826	61,386
N+6.85	C35	ENVOLVENTE MIN	0	-121,48	-22,1	0,58	-6,622	15,596	-36,028
N+6.85	C35	ENVOLVENTE MIN	1,75	-109,38	-22,1	0,58	-6,622	36,829	-4,852
N+6.85	C35	ENVOLVENTE MIN	3,5	-97,29	-22,1	0,58	-6,622	-52,298	-51,846
N+3.45	C35	ENVOLVENTE MAX	0	-341,72	28,02	89,57	2,954	127,972	82,092
N+3.45	C35	ENVOLVENTE MAX	1,75	-332,65	28,02	89,57	2,954	-6,525	14,167
N+3.45	C35	ENVOLVENTE MAX	3,5	-323,58	28,02	89,57	2,954	-97,427	46,492
N+3.45	C35	ENVOLVENTE MIN	0	-576,28	-27,5	0,55	-4,065	-100,213	-59,642
N+3.45	C35	ENVOLVENTE MIN	1,75	-562,16	-27,5	0,55	-4,065	-121,621	-11,811
N+3.45	C35	ENVOLVENTE MIN	3,5	-548,05	-27,5	0,55	-4,065	-191,625	-35,061
N+6.85	C36	ENVOLVENTE MAX	0	-100,41	74,28	42,13	10,033	22,09	154,472
N+6.85	C36	ENVOLVENTE MAX	1,75	-87	74,28	42,13	10,033	-2,956	12,608
N+6.85	C36	ENVOLVENTE MAX	3,5	-73,88	74,28	42,13	10,033	76,163	96,521
N+6.85	C36	ENVOLVENTE MIN	0	-261,39	-15,62	-65,28	-14,087	-91,181	1,046
N+6.85	C36	ENVOLVENTE MIN	1,75	-243,28	-15,62	-65,28	-14,087	-65,16	17,659
N+6.85	C36	ENVOLVENTE MIN	3,5	-225,1	-15,62	-65,28	-14,087	-89,262	-106,341
N+3.45	C36	ENVOLVENTE MAX	0	-346,5	82,96	51,14	7,176	252,725	192,11
N+3.45	C36	ENVOLVENTE MAX	1,75	-327,9	82,96	51,14	7,176	65,875	21,02
N+3.45	C36	ENVOLVENTE MAX	3,5	-305,28	82,96	51,14	7,176	117,305	-72,996
N+3.45	C36	ENVOLVENTE MIN	0	-617,65	-65,09	-92,68	-9,828	-238,174	-265,023
N+3.45	C36	ENVOLVENTE MIN	1,75	-599,31	-65,09	-92,68	-9,828	-68,596	-187,726
N+3.45	C36	ENVOLVENTE MIN	3,5	-581,18	-65,09	-92,68	-9,828	-27,328	-166,887

9.3 VERIFICACIONES

PROYECTO: MARIA INMACULADA
RESISTENCIA A CORTANTE PARA VIGAS
CHEQUEO PARA LA CONDICIÓN DESCRITA EN C.21.3.3.1 (a)

f'_c = 21,1 MPa
f_y = 420 MPa
$\phi_{cortante}$ = 0,75
Estribos Φ = 9,5 mm
Av = 71 mm²
Ri = 7,00

Mn = [illegible]
Vg = Cortante calculado para cargas gravitacionales mayoradas.
Ve = Cortante debido a flexión en curvatura inversa.
Vu = Vm + Vg

COMB03 = [illegible]
COMB04 = [illegible]
COMB05 = [illegible]
COMB06 = [illegible]
COMB07 = [illegible]
COMB08 = [illegible]
COMB09 = [illegible]
COMB10 = [illegible]
COMB11 = [illegible]
COMB12 = [illegible]
COMB13 = [illegible]
COMB14 = [illegible]
COMB15 = [illegible]
COMB16 = [illegible]
COMB17 = [illegible]
COMB18 = [illegible]

NIVEL	VIGA No.	LOC. (m)	LONG. (m)	SECCION	b (m)	d (m)	C.M. (KN.m)	C.V. (KN.m)	SISMO X (KN.m)	SISMO Y (KN.m)	-SISMO X (KN.m)	-SISMO Y (KN.m)	COMB03	COMB04	COMB05	COMB06	COMB07	COMB08	COMB09	COMB10	COMB11	COMB12	COMB13	COMB14	COMB15	COMB16	COMB17	COMB18
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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PROYECTO: MARIA INMACULADA
RESISTENCIA A CORTANTE PARA VIGAS
CHEQUEO PARA LA CONDICIÓN DESCRITA EN C.21.3.3.1 (a)

f'c =	21,1 MPa
fy =	420 MPa
$\Phi_{cortante}$ =	0,75
Estribos Φ =	9,5 mm
Av =	71 mm²
N=	7,00

Mn = Momentos nominales de la viga en cada extremo [illegible] de la luz libre
Vg = Cortante calculado para cargas gravitacionales mayoradas
Ve = Cortante debido a flexión en curvatura inversa
Vu = Ve + Vg

V_g	Ve = Mn + Mn / ln															
	COMBO103	COMBO104	COMBO105	COMBO106	COMBO107	COMBO108	COMBO109	COMBO110	COMBO111	COMBO112	COMBO113	COMBO114	COMBO115	COMBO116	COMBO117	COMBO118
(kN)	(kN)															
[illegible] / [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible] / [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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PROYECTO: MARIA INMACULADA
RESISTENCIA A CORTANTE PARA VIGAS
CHEQUEO PARA LA CONDICIÓN DESCRITA EN C.21.3.3.1 (a)

$f'c$ =	21,1 MPa
fy =	420 MPa
$\Phi_{cortante}$ =	0,75
Estribos Φ =	9,5 mm
Av =	71 mm²
[illegible] =	7,00

[illegible]

Vp = Vm + Vg																Vp_{max} (kN)	L (m)	ΦVc (kN)	ΦVs (kN)	ΦVn (kN)	ΦVn > Vp_{max}
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
(kN)																					
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	OK
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	OK
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	OK
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	OK
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	OK
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	OK

PROYECTO: MARIA INMACULADA
RESISTENCIA A CORTANTE PARA VIGAS
CHEQUEO PARA LA CONDICIÓN DESCRITA EN C.21.3.3.1 (a)

f'c = 21,1 MPa
fy = 420 MPa
$\Phi_{Cortante}$ = 0,75
Estribos Φ = 9,5 mm
Av = 71 mm²
R = 7,00

Mn = Momentos nominales de la viga en cada extremo restringido de la luz libre.
Vg = Cortante calculado para cargas gravitacionales mayoradas.
Ves = Cortante debido a flexion en curvatura inversa.
Vu = Vm + Vg

COMBDIS3 = 1.2C.M.+1.0C.V.+1.0Ex+0.3Ey
COMBDIS4 = 1.2C.M.+1.0C.V.+1.0(-Ex)+0.3Ey
COMBDIS5 = 1.2C.M.+1.0C.V.+1.0Ex+0.3(-Ey)
COMBDIS6 = 1.2C.M.+1.0C.V.+1.0(-Ex)+0.3(-Ey)
COMBDIS7 = 1.2C.M.+1.0C.V.+0.3Ex+1.0Ey
COMBDIS8 = 1.2C.M.+1.0C.V.+0.3(-Ex)+1.0Ey
COMBDIS9 = 1.2C.M.+1.0C.V.+0.3Ex+1.0(-Ey)
COMBDIS10 = 1.2C.M.+1.0C.V.+0.3(-Ex)+1.0(-Ey)
COMBDIS11 = 0.9C.M.+1.0Ex+0.3Ey
COMBDIS12 = 0.9C.M.+1.0(-Ex)+0.3Ey
COMBDIS13 = 0.9C.M.+1.0Ex+0.3(-Ey)
COMBDIS14 = 0.9C.M.+1.0(-Ex)+0.3(-Ey)
COMBDIS15 = 0.9C.M.+0.3Ex+1.0Ey
COMBDIS16 = 0.9C.M.+0.3(-Ex)+1.0Ey
COMBDIS17 = 0.9C.M.+0.3Ex+1.0(-Ey)
COMBDIS18 = 0.9C.M.+0.3(-Ex)+1.0(-Ey)

NIVEL	VIGA ELEMENTO No.	LOC. (m)	LONG. (m)	PROPIEDADES DEL ELEMENTO: SECCION	b (m)	d (m)	M3: C.M. (KN.m)	C.V. (KN.m)	SISMO X (KN.m)	SISMO Y (KN.m)	-SISMO X (KN.m)	-SISMO Y (KN.m)	Mn (kN.m) Combinaciones para resistencias nominales a momento: COMBDIS3	COMBDIS4	COMBDIS5	COMBDIS6	COMBDIS7	COMBDIS8	COMBDIS9	COMBDIS10	COMBDIS11	COMBDIS12	COMBDIS13	COMBDIS14	COMBDIS15	COMBDIS16	COMBDIS17	COMBDIS18
	B51	7,900					-30,862	-0,647	3,446	6,672	-3,445	-6,672	42,903	40,800	43,475	44,459	42,581	42,876	44,487	44,782	31,486	32,402	32,070	33,054	31,175	31,470	33,081	33,377
N+6.95	B52	0,000	5,300	VIG15X45	0,15	0,40	-9,163	-8,804	6,318	2,049	-6,318	-2,049	16,775	18,500	17,019	18,824	17,122	17,663	17,836	18,477	7,222	9,037	7,467	9,271	7,569	8,110	8,303	8,924
	B52	5,300					-10,110	-7,534	6,924	3,138	-6,924	-3,138	18,532	20,511	18,801	20,780	18,911	19,504	19,808	20,401	7,975	9,954	8,244	10,223	8,354	8,947	9,251	9,844
N+3.45	B53	0,000	5,300	VIG15X45	0,15	0,40	-44,143	-9,972	8,845	3,288	-8,845	-3,288	61,539	64,066	61,821	64,348	62,095	62,853	63,134	63,780	38,324	40,851	38,606	41,133	38,880	39,638	39,819	40,577
	B53	5,300					-10,881	-7,883	11,160	7,437	-11,160	-7,437	28,637	31,816	29,265	32,453	28,999	29,956	31,134	32,061	15,000	18,268	15,717	18,906	15,453	16,409	17,577	18,534
N+6.95	B54	0,000	2,200	VIG40X45	0,40	0,40	0,013	0,050	0,180	0,375	-0,180	-0,375	0,115	0,064	0,083	0,032	0,135	0,119	0,026	0,012	0,053	0,002	0,021	0,030	0,073	0,058	0,004	0,050
	B54	2,200					-1,723	-0,162	0,312	0,685	-0,312	-0,685	2,154	2,244	2,215	2,302	2,117	2,144	2,313	2,340	1,476	1,565	1,536	1,624	1,439	1,465	1,634	1,661
N+3.45	B54	0,000	2,200	VIG40X45	0,40	0,40	11,683	0,009	0,318	0,475	-0,318	-0,475	14,093	14,005	14,053	13,964	14,110	14,083	13,974	13,947	10,579	10,491	10,539	10,450	10,596	10,569	10,460	10,434
	B54	2,200					-172,337	0,307	2,874	6,719	-2,874	-6,719	205,799	206,620	206,375	207,196	205,404	205,661	207,324	207,580	154,405	155,226	154,981	155,802	154,020	154,267	155,940	156,186
N+6.95	B55	0,000	2,200	VIG40X45	0,40	0,40	-0,147	-0,056	0,137	0,487	-0,137	-0,487	0,182	0,221	0,224	0,273	0,157	0,169	0,286	0,300	0,092	0,131	0,134	0,173	0,057	0,069	0,196	0,208
	B55	2,200					-1,605	-0,112	0,299	0,765	-0,299	-0,765	1,963	2,048	2,028	2,114	1,916	1,942	2,134	2,160	1,369	1,454	1,435	1,520	1,322	1,348	1,541	1,567
N+3.45	B55	0,000	2,200	VIG40X45	0,40	0,40	10,834	-0,261	0,129	0,535	-0,129	-0,535	12,541	12,504	12,495	12,458	12,582	12,571	12,429	12,418	9,612	9,575	9,566	9,529	9,653	9,642	9,500	9,489
	B55	2,200					-165,022	0,139	2,869	7,126	-2,869	-7,126	197,172	197,992	197,780	198,603	196,746	196,992	198,782	199,028	147,808	148,634	148,415	149,235	147,379	147,625	149,415	149,661
N+6.95	B56	0,000	2,200	VIG40X45	0,40	0,40	1,637	1,557	0,422	1,222	-0,422	-1,222	3,634	3,513	3,529	3,409	3,714	3,678	3,368	3,329	1,586	1,465	1,481	1,361	1,666	1,630	1,317	1,281
	B56	2,200					-54,747	-37,307	4,668	5,564	-4,668	-5,564	101,998	103,333	102,475	103,809	101,908	102,309	103,498	103,898	48,367	49,701	48,844	50,178	48,277	48,678	49,867	50,267
N+3.45	B56	0,000	2,200	VIG40X45	0,40	0,40	15,580	0,269	0,514	0,260	-0,514	-0,260	19,035	18,800	19,013	18,866	19,010	18,966	18,935	18,891	14,096	13,949	14,073	13,927	14,070	14,026	13,996	13,952
	B56	2,200					-230,184	-53,554	5,832	13,104	-5,832	-13,104	328,380	330,046	329,500	331,170	327,653	328,153	331,397	331,897	205,771	207,437	206,894	208,560	205,044	205,544	208,788	209,288
N+6.95	B57	0,000	2,200	VIG40X45	0,40	0,40	-0,159	-0,132	0,083	0,144	-0,083	-0,144	0,305	0,328	0,317	0,341	0,299	0,306	0,340	0,347	0,125	0,149	0,137	0,161	0,119	0,126	0,160	0,167
	B57	2,200					-50,617	-32,496	5,432	2,582	-5,432	-2,582	92,250	93,902	93,571	94,123	92,628	92,100	93,372	93,838	44,669	46,221	44,890	46,442	44,954	45,419	45,691	46,157
N+3.45	B57	0,000	2,200	VIG40X45	0,40	0,40	0,047	-0,806	0,588	1,098	-0,588	-1,098	0,101	0,067	0,007	0,181	0,152	0,102	0,161	0,212	0,713	0,546	0,619	0,451	0,764	0,714	0,451	0,400
	B57	2,200					-151,471	-54,601	6,190	11,990	-6,190	-11,990	234,968	236,737	235,996	237,764	234,388	234,919	237,814	238,344	134,920	136,694	135,953	137,722	134,346	134,876	137,771	138,300
N+3.45	B58	0,000	8,640	VIG40X45	0,40	0,40	-40,573	0,071	6,612	10,035	-6,612	-10,035	50,842	52,731	51,702	53,591	50,500	51,066	53,367	53,934	37,041	39,730	38,701	40,590	37,499	38,066	40,368	40,933
	B58	8,640					-82,703	-0,095	8,686	13,077	-8,686	-13,077	97,537	100,019	98,688	101,140	97,098	97,843	100,834	101,579	72,631	75,113	73,752	76,234	72,192	72,937	75,929	76,673
N+3.45	B59	0,000	2,200	VIG40X45	0,40	0,40	-55,460	-0,042	4,161	5,945	-4,161	-5,945	65,784	66,973	66,294	67,483	65,608	65,963	67,305	67,661	49,094	50,283	49,604	50,793	48,916	49,273	50,615	50,971
	B59	2,200					-9,064	-0,003	0,321	0,613	-0,321	-0,613	10,736	10,827	10,788	10,880	10,766	10,754	10,882	10,909	8,031	8,123	8,084	8,176	8,002	8,030	8,177	8,205
N+3.45	B60	0,000	8,640	VIG40X45	0,40	0,40	-37,802	0,572	4,438	10,894	-4,438	-10,894	43,690	44,950	44,623	45,891	43,044	43,424	46,150	46,537	32,921	34,189	33,855	35,123	32,275	32,658	35,388	35,768
	B60	8,640					-87,075	-0,808	5,917	14,546	-5,917	-14,546	103,829	105,320	105,076	106,767	102,966	103,474	107,122	107,630	76,899	78,589	78,146	79,836	76,036	76,540	80,192	80,699
N+3.45	B61	0,000	2,200	VIG40X45	0,40	0,40	-57,196	-0,265	2,799	6,837	-2,799	-6,837	68,207	69,007	68,793	69,593	67,804	68,043	69,757	69,997	50,764	51,583	51,370	52,169	50,380	50,620	52,333	52,573
	B61	2,200					-11,603	-0,075	0,204	0,515	-0,204	-0,515	13,947	14,006	13,992	14,050	13,918	13,934	14,063	14,081	10,391	10,450	10,436	10,494	10,360	10,378	10,508	10,525
N+3.45	B62	0,000	8,640	VIG40X45	0,40	0,40	-38,051	1,840	2,817	15,000	-2,817	-15,000	42,778	43,581	44,062	44,860	41,558	41,799	45,843	46,085	33,201	34,003	34,486	35,291	31,982	32,224	36,268	36,509
	B62	8,640					-93,259	-4,513	4,746	19,046	-4,746	-19,046	114,904	115,260	116,508	117,944	113,404	113,821	119,027	119,454	82,413	83,769	84,097	85,453	80,923	81,330	86,536	86,943
N+3.45	B63	0,000	2,200	VIG40X45	0,40	0,40	-54,098	-3,941	2,786	8,966	-2,786	-8,966	80,076	80,872	80,845	81,641	79,458	79,697	82,020	82,259	56,906	57,702	57,674	58,470	56,288	56,527	58,850	59,088
	B63	2,200					-12,719	-1,514	0,177	0,736	-0,177	-0,736	16,720	16,771	16,783	16,834	16,664	16,679	16,874	16,890	11,390	11,441	11,453	11,504	11,334	11,350	11,545	11,560
N+3.45	B64	0,000	8,640	VIG40X45	0,40	0,40	-33,825	4,436	4,094	25,670	-4,094	-25,670	34,467	35,637	36,667	37,837	32,309	32,660	39,644	39,995	28,758	29,927	30,958	33,128	26,600	26,951	33,934	34,285
	B64	8,640					-143,495	-26,015	5,422	34,092	-5,422	-34,092	195,939	197,488	198,930	200,479	192,992	193,457	202,961	203,426	126,876	128,425	129,868	131,415	123,929	124,393	133,898	134,362
N+6.95	B66	0,000	5,300	VIG40X45	0,40	0,40	-144,265	-39,450	2,788	18,144	-2,788	-18,144	211,392	212,189	212,947	213,744	209,857	210,095	215,041	215,279	128,663	129,459	130,218	131,014	127,127	127,368	132,311	132,558
	B66	5,300					-6,374	2,407	0,242	0,336	-0,242	-0,336	7,593	7,663	7,622	7,691	7,583	7,604	7,679	7,700	7,483	7,557	7,518	7,586	7,478	7,499	7,574	7,596

PROYECTO: MARIA INMACULADA
RESISTENCIA A CORTANTE PARA VIGAS
CHEQUEO PARA LA CONDICIÓN DESCRITA EN C.21.3.3.1 (a)

F'c =	21,1	MPa
fy =	420	MPa
$\Phi_{Cortante}$ =	0,75	
Estribos Φ =	9,5	mm
Av =	71	mm^2
R=	7,00	

Mn = Momentos nominales de la viga en cada extremo restringido de la luz libre.
Vg = Cortante calculado para cargas gravitacionales mayoradas.
Vm = Cortante debido a flexion en curvatura inversa.
Va = Vm + Vg

V_g (kN)	$V_m = M_{nl} + M_{nr} / L$ (kN)															
	COMBDIS3	COMBDIS4	COMBDIS5	COMBDIS6	COMBDIS7	COMBDIS8	COMBDIS9	COMBDIS10	COMBDIS11	COMBDIS12	COMBDIS13	COMBDIS14	COMBDIS15	COMBDIS16	COMBDIS17	COMBDIS18
33,580	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
36,232 37,112	6,662	7,376	6,759	7,472	6,799	7,013	7,121	7,336	2,867	3,581	2,964	3,678	3,004	3,218	3,327	3,541
121,552 110,220	17,013	18,091	17,106	18,264	17,188	17,511	17,766	18,089	10,076	11,155	10,250	11,328	10,251	10,575	10,830	11,153
0,712 1,504	1,032	1,049	1,044	1,061	1,024	1,029	1,064	1,069	0,696	0,712	0,707	0,752	0,687	0,692	0,758	0,778
82,096 118,204	99,951	100,284	100,194	100,527	99,754	99,884	100,595	100,694	74,992	75,326	75,236	75,569	74,826	74,925	75,626	75,736
0,444 1,236	0,979	1,036	1,028	1,085	0,942	0,959	1,105	1,122	0,664	0,721	0,713	0,769	0,627	0,644	0,790	0,807
77,472 113,580	95,324	95,680	96,001	95,937	95,149	95,256	96,005	96,112	71,553	71,909	71,810	72,166	71,378	71,485	72,234	72,341
44,980 72,900	48,015	48,566	48,184	48,735	48,010	48,176	48,574	48,740	22,706	23,257	22,875	23,426	22,702	22,867	23,265	23,431
155,128 191,236	157,918	158,607	158,416	159,107	157,574	157,781	159,242	159,449	99,839	100,620	100,440	101,130	99,597	99,804	101,265	101,473
37,112 65,020	42,118	42,832	42,222	42,938	42,242	42,457	42,596	42,811	20,361	21,077	20,467	21,183	20,488	20,702	20,842	21,056
110,220 133,968	106,859	107,638	107,274	108,148	106,609	106,820	108,170	108,435	61,654	62,382	62,079	62,806	61,414	61,632	62,828	63,046
74,580 80,312	17,174	17,679	17,403	17,909	17,083	17,235	17,847	17,999	12,786	13,290	13,015	13,521	12,696	12,847	13,460	13,612
43,436 7,340	34,782	35,364	35,037	35,619	34,687	34,862	35,539	35,714	25,966	26,548	26,222	26,804	25,872	26,047	26,724	26,898
72,740 85,232	17,074	17,416	17,226	17,569	16,899	17,002	17,741	17,843	12,711	13,053	12,963	13,305	12,536	12,639	13,377	13,480
43,068 6,960	37,340	37,733	37,629	38,019	37,145	37,262	38,100	38,217	27,807	28,197	28,093	28,483	27,609	27,726	28,564	28,681
71,364 86,888	18,250	18,500	18,594	18,844	17,937	18,012	19,082	19,157	13,381	13,631	13,725	13,975	13,068	13,143	14,213	14,288
47,840 11,732	43,998	44,383	44,376	44,761	43,692	43,807	44,952	45,067	31,044	31,429	31,422	31,807	30,737	30,853	31,997	32,113
80,580 102,492	26,867	26,962	27,268	27,583	26,077	26,171	28,079	28,174	18,013	18,328	18,614	18,929	17,422	17,517	19,425	19,519
122,620 86,524	41,318	41,461	41,617	41,760	41,026	41,075	42,023	42,072	25,689	25,853	25,988	26,151	25,397	25,446	26,393	26,442

PROYECTO: MARIA INMACULADA
RESISTENCIA A CORTANTE PARA VIGAS
CHEQUEO PARA LA CONDICION DESCRITA EN C.21.3.3.1 (a)

f'c =	21,1	MPa
fy =	420	MPa
$\Phi_{Cortante}$ =	0,75	
Estribos Φ =	9,5	mm
Av =	71	mm^2
R=	7,00	

Mn = Momentos nominales de la viga en cada extremo restringido de la luz libre.
Vg = Cortante calculado para cargas gravitacionales mayoradas.
Vm = Cortante debido a flexion en curvatura inversa.
Vu = Vm + Vg

Vu = Vm + Vg																Vu_{max}	S	ΦVs	ΦVc	ΦVn	ΦVn > Vu_{max}
COMBDIS3	COMBDIS4	COMBDIS5	COMBDIS6	COMBDIS7	COMBDIS8	COMBDIS9	COMBDIS10	COMBDIS11	COMBDIS12	COMBDIS13	COMBDIS14	COMBDIS15	COMBDIS16	COMBDIS17	COMBDIS18						
(kN)																(kN)	(m)	(kN)	(kN)	(kN)	
33,500	33,500	33,500	33,500	33,500	33,500	33,500	33,500	33,500	33,500	33,500	33,500	33,500	33,500	33,500	33,500						
42,894	43,606	42,891	43,704	43,031	43,248	43,353	43,588	39,099	39,813	39,196	39,910	39,226	39,450	39,559	39,773	43,7	0,10	178,92	34,45	213,37	OK
37,112	37,112	37,112	37,112	37,112	37,112	37,112	37,112	37,112	37,112	37,112	37,112	37,112	37,112	37,112	37,112						
138,565	139,643	138,738	139,816	138,740	139,063	139,318	139,641	131,628	132,707	131,802	132,880	131,803	132,127	132,382	132,705	139,8	0,10	178,92	34,45	213,37	OK
110,220	110,220	110,220	110,220	110,220	110,220	110,220	110,220	110,220	110,220	110,220	110,220	110,220	110,220	110,220	110,220						
1,744	1,761	1,756	1,773	1,736	1,741	1,776	1,781	1,407	1,424	1,419	1,404	1,399	1,404	1,470	1,490	1,8	0,10	178,92	91,87	270,79	OK
1,504	1,504	1,504	1,504	1,504	1,504	1,504	1,504	1,504	1,504	1,504	1,504	1,504	1,504	1,504	1,504						
182,047	182,380	182,296	182,620	181,880	181,980	182,691	182,790	157,089	157,423	157,332	157,668	156,922	157,021	157,732	157,832	182,8	0,10	178,92	91,87	270,79	OK
118,204	118,204	118,204	118,204	118,204	118,204	118,204	118,204	118,204	118,204	118,204	118,204	118,204	118,204	118,204	118,204						
1,423	1,480	1,472	1,529	1,386	1,403	1,549	1,566	1,108	1,165	1,157	1,213	1,071	1,088	1,234	1,251	1,6	0,10	178,92	91,87	270,79	OK
1,236	1,236	1,236	1,236	1,236	1,236	1,236	1,236	1,236	1,236	1,236	1,236	1,236	1,236	1,236	1,236						
172,796	173,152	173,052	173,409	172,621	172,720	173,477	173,584	149,025	149,381	149,282	149,638	148,850	148,957	149,706	149,812	173,6	0,10	178,92	91,87	270,79	OK
113,580	113,580	113,580	113,580	113,580	113,580	113,580	113,580	113,580	113,580	113,580	113,580	113,580	113,580	113,580	113,580						
92,995	93,046	93,164	93,715	92,990	93,156	93,554	93,720	67,606	68,237	67,855	68,406	67,602	67,847	68,245	68,411	93,7	0,10	178,92	91,87	270,79	OK
72,900	72,900	72,900	72,900	72,900	72,900	72,900	72,900	72,900	72,900	72,900	72,900	72,900	72,900	72,900	72,900						
313,044	313,735	313,544	314,236	312,702	312,909	314,370	314,577	255,067	255,758	255,568	256,258	254,725	254,932	256,393	256,601	314,6	0,10	232,60	91,87	324,47	OK
191,236	191,236	191,236	191,236	191,236	191,236	191,236	191,236	191,236	191,236	191,236	191,236	191,236	191,236	191,236	191,236						
79,220	79,844	79,334	80,050	79,254	79,509	79,708	79,923	57,473	58,109	57,579	58,295	57,600	57,814	57,954	58,168	80,1	0,10	178,92	91,87	270,79	OK
65,020	65,020	65,020	65,020	65,020	65,020	65,020	65,020	65,020	65,020	65,020	65,020	65,020	65,020	65,020	65,020						
217,070	217,858	217,494	218,288	216,829	217,048	218,290	218,653	171,874	172,603	172,299	173,028	171,634	171,852	173,048	173,268	218,7	0,10	178,92	91,87	270,79	OK
133,968	133,968	133,968	133,968	133,968	133,968	133,968	133,968	133,968	133,968	133,968	133,968	133,968	133,968	133,968	133,968						
91,734	92,239	91,983	92,489	91,640	91,795	92,407	92,539	87,346	87,852	87,575	88,081	87,256	87,407	88,020	88,172	92,6	0,10	178,92	91,87	270,79	OK
83,312	83,312	83,312	83,312	83,312	83,312	83,312	83,312	83,312	83,312	83,312	83,312	83,312	83,312	83,312	83,312						
78,318	78,800	78,473	79,055	78,123	78,296	78,975	79,150	69,402	69,984	69,658	70,240	69,308	69,483	70,160	70,334	79,1	0,10	178,92	91,87	270,79	OK
7,340	7,340	7,340	7,340	7,340	7,340	7,340	7,340	7,340	7,340	7,340	7,340	7,340	7,340	7,340	7,340						
89,814	90,156	90,066	90,409	89,639	89,742	90,481	90,583	85,451	85,793	85,703	86,045	85,276	85,379	86,117	86,220	90,6	0,10	178,92	91,87	270,79	OK
85,232	85,232	85,232	85,232	85,232	85,232	85,232	85,232	85,232	85,232	85,232	85,232	85,232	85,232	85,232	85,232						
80,411	80,601	80,697	81,087	80,213	80,330	81,168	81,265	70,875	71,265	71,161	71,551	70,677	70,794	71,632	71,749	81,3	0,10	178,92	91,87	270,79	OK
6,960	6,960	6,960	6,960	6,960	6,960	6,960	6,960	6,960	6,960	6,960	6,960	6,960	6,960	6,960	6,960						
89,614	89,064	89,958	90,208	89,301	89,376	90,446	90,521	84,745	84,995	85,089	85,339	84,432	84,507	85,577	85,852	90,5	0,10	178,92	91,87	270,79	OK
86,000	86,000	86,000	86,000	86,000	86,000	86,000	86,000	86,000	86,000	86,000	86,000	86,000	86,000	86,000	86,000						
91,830	92,223	92,216	92,601	91,532	91,647	92,792	92,907	78,884	79,269	79,263	79,647	78,577	78,693	79,837	79,953	92,9	0,10	178,92	91,87	270,79	OK
11,732	11,732	11,732	11,732	11,732	11,732	11,732	11,732	11,732	11,732	11,732	11,732	11,732	11,732	11,732	11,732						
87,247	87,562	87,848	88,163	86,657	86,751	88,059	86,754	78,593	78,908	79,194	79,509	78,002	78,097	80,005	80,099	102,5	0,10	178,92	91,87	270,79	OK
102,492	102,492	102,492	102,492	102,492	102,492	102,492	102,492	102,492	102,492	102,492	102,492	102,492	102,492	102,492	102,492						
163,938	164,101	164,237	164,400	163,646	163,695	164,643	164,692	148,309	148,473	148,608	148,771	148,017	148,066	149,013	149,062	164,7	0,10	178,92	91,87	270,79	OK
86,524	86,524	86,524	86,524	86,524	86,524	86,524	86,524	86,524	86,524	86,524	86,524	86,524	86,524	86,524	86,524						

RESISTENCIA A CORTANTE PARA VIGAS
CHEQUEO PARA LA CONDICIÓN DESCRITA EN C.21.3.3.1 (b)

F'c = 21,0 MPa
fy = 420 MPa
$\Phi_{cortante}$ = 0,75
Estribos Φ = 9,5 mm
Av = 71 mm²
R= 7,00

2VE = Cortante máximo obtenido de las combinaciones de carga de diseño que incluyen E, considerando E, como el doble del prescrito por el reglamento general (…) para diseño (…)

COMBO33 = 1.2C.M.+1.0C.V.+(…)
(…)

NIVEL	VIGA ELEMENTO No.	LOC. (m)	LONG. (m)	SECCION	b (m)	d (m)	C.M. (KN.m)	C.V. (KN.m)	SISMO X (KN.m)	SISMO Y (KN.m)	-SISMO X (KN.m)	-SISMO Y (KN.m)	Combinaciones de carga de diseño (…)	$2V_{Emax}$ (kN)	S (m)	ΦVs (kN)	ΦVc (kN)	ΦVn (kN)	$\Phi Vn > 2V_{Emax}$
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	OK

PROYECTO: MARIA INMACULADA
RESISTENCIA A CORTANTE PARA VIGAS
CHEQUEO PARA LA CONDICIÓN DESCRITA EN C.21.3.3.1 (b)

f'c = 21,0 MPa
fy = 420 MPa
Φ corte = 0,75
Estribos Φ = [illegible]
Av = 71 mm²
R = 7,00

2Vi = [illegible]

NIVEL	VIGA	LOC. (m)	LONG. (m)	SECCION	b (m)	d (m)	C.M. (KN.m)	C.V. (KN.m)	SISMO X (KN.m)	SISMO Y (KN.m)	-SISMO X (KN.m)	-SISMO Y (KN.m)	COMBO3 … COMBO18	2Vmax (kN)	S (m)	ΦVs (kN)	ΦVc (kN)	ΦVn (kN)	ΦVn > 2Vmax
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	OK

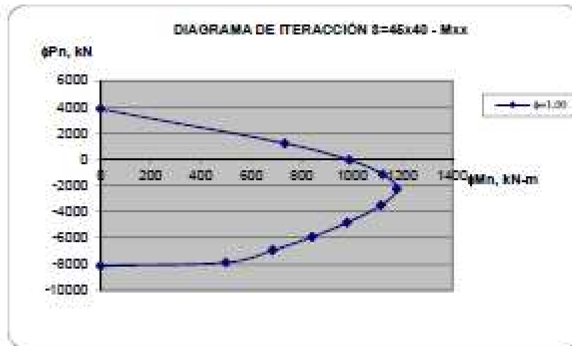
PROYECTO: MARIA INMACULADA
RESISTENCIA A CORTANTE PARA COLUMNAS
CHEQUEO PARA LA CONDICIÓN DESCRITA EN C.21.3.3.2 (a) - COLUMNA S=60X60 (12/#6 #7 (1.1%))

f'c =	21,1	MPa	Estribos Φ =	9,5	mm
fy =	420	MPa	Av =	71	mm^2
$\Phi_{Cortante}$ =	0,75		Cantidad de ramas =	4	
bx =	0,60	m	S =	0,10	m
by =	0,60	m	Recub. =	0,05	m
Lcol =	7,50	m			

C.21.3.3.2(a) El cortante ΦVn no debe ser menor que la suma del cortante debido a flexión en curvatura inversa asociado con el desarrollo de los momentos nominales de la columna en cada extremo restringido de la longitud libre.

DATOS PARA LOS DIAGRAMAS DE ITERACCIÓN

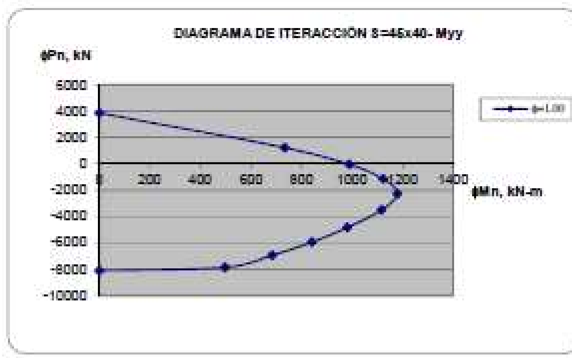
No.	Curve 1	0. degrees	
	P	M3	M2
1	-8114,00	0,00	0,00
2	-7864,00	497,74	0,00
3	-6938,00	683,46	0,00
4	-5946,00	840,48	0,00
5	-4835,00	980,28	0,00
6	-3512,00	1116,12	0,00
7	-2269,00	1178,71	0,00
8	-1157,00	1122,66	0,00
9	-46,56	988,26	0,00
10	1223,84	732,00	0,00
11	3847,73	0,00	0,00



P_{ua} = 1083,11 kN
P_{ub} = 1046,82 kN
ΦM_{na} = 959,87 kN-m
ΦM_{nb} = 952,55 kN-m
$V_{umáx}$ = 254,99 kN
ΦV_s = 492,03 kN
ΦV_c = 189,48 kN
ΦV_n = 681,51 kN
$\Phi V_n > V_{umáx}$ = OK

DATOS PARA LOS DIAGRAMAS DE ITERACCIÓN

No.	Curve 7	90. degrees	
	P	M3	M2
1	-8114,00	0,00	0,00
2	-7864,00	0,00	497,74
3	-6938,00	0,00	683,46
4	-5946,00	0,00	840,48
5	-4835,00	0,00	980,28
6	-3512,00	0,00	1116,12
7	-2269,00	0,00	1178,71
8	-1157,00	0,00	1122,66
9	-46,56	0,00	988,26
10	1223,84	0,00	732,00
11	3847,73	0,00	0,00



P_{ua} = 1094,04 kN
P_{ub} = 1057,75 kN
ΦM_{na} = 962,08 kN-m
ΦM_{nb} = 954,76 kN-m
$V_{umáx}$ = 255,58 kN
ΦV_s = 492,03 kN
ΦV_c = 189,48 kN
ΦV_n = 681,51 kN
$\Phi V_n > V_{umáx}$ = OK

PROYECTO: MARIA INMACULADA
RESISTENCIA A CORTANTE PARA COLUMNAS
CHEQUEO PARA LA CONDICIÓN DESCRITA EN C.21.3.3.2 (b)

f'c =	21,1	MPa	**Estribos Φ =**	9,5	mm
fy =	420	MPa	**Av =**	71	mm^2
$\Phi_{Cortante}$ =	0,75		**Cantidad de ramas =**	4	
bx =	0,60	m	**S =**	0,10	m
by =	0,60	m	**Ω_o=**	3,00	
			Recub. =	0,05	m

C.21.3.3.2(b) El cortante ΦVn no debe ser menor que el cortante maximo obtenido de la que incluyan E, con E incrementado por medio de Ωo.

Para cortante V2

Ω_o*$V_{umáx}$ =	240,46	kN
ΦV_s =	492,03	kN
ΦV_c =	189,48	kN
ΦV_n =	681,51	kN
$\Phi V_n > \Omega_o$*$V_{umáx}$ =	OK	

Para cortante V3

Ω_o*$V_{umáx}$ =	256,40	kN
ΦV_s =	492,03	kN
ΦV_c =	189,48	kN
ΦV_n =	681,51	kN
$\Phi V_n > \Omega_o$*$V_{umáx}$ =	OK	

10 BIBLIOGRAFIA

- Norma Colombiana de Diseño y Construcción Sismo Resistente Ley 400 de 1997 (Modificada Ley 1229 de 2008) y Decreto 926 de Marzo de 2010, Decreto 092 del 17 de Enero de 2011, Decreto 0340 del 13 de Febrero de 2012
- Reglamento para Concreto Estructural ACI 318S-08.

ELABORACIÓN DE DIAGNÓSTICOS, ESTUDIOS TÉCNICOS, AJUSTES A DISEÑOS O DISEÑOS INTEGRALES, CONSTRUCCIÓN Y PUESTA EN FUNCIONAMIENTO DE LAS OBRAS DE INFRAESTRUCTURA EDUCATIVA – UBICADAS EN EL DEPARTAMENTO DE VALLE DEL CAUCA – GRUPO 02

Contrato No. PAF-JU02-G02DC-2015

INFORME CÁLCULO Y ANALISIS ESTRUCTURAL INSTITUCIÓN EDUCATIVA ALFREDO BONILLASEDE No. 2 MARIA INMACULADA (RAMPA)

VERSION 0

BOGOTÁ
2017

CONTROL DE REVISIONES

REVISIÓN	FECHA	OBSERVACIONES
1	30/12/16	Primera Redacción

Elaborado por:	Revisado por:	Aprobado por:
Edgar Rolando Barrera Firma:	Javier José Carrillo Ortega Fecha: Enero 2017 Firma:	Director de Interventoría Fecha: Firma:

TABLA DE CONTENIDO

LISTA DE FOTOGRAFÍAS

1 INTRODUCCIÓN

El presente documento contiene las memorias de análisis y diseño estructural correspondiente al proyecto de la "INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMAULADA" ubicado en el municipio de JAMUNDÍ en el departamento de VALLE DEL CAUCA de acuerdo al contrato No. PAF-JU02-G02DC-2015 realizando el estudio de acuerdo a la Norma Colombiana de Diseño y Construcción Sismo Resistente Ley 400 de 1997 (Modificada Ley 1229 de 2008) y Decreto 926 de Marzo de 2010, Decreto 092 del 17 de Enero de 2011, Decreto 0340 del 13 de Febrero de 2012 y en el Reglamento para Concreto Estructural ACI 318S-08.

Para la evaluación de la edificación se ha seguido un proceso normativo que incluye las etapas de inspección, evaluación, pruebas y ensayos, revisión analítica, propuesta de intervención y soluciones constructivas, que tomen en cuenta los aspectos de resistencia, ductilidad, comportamiento y estabilidad de la estructura.

2 DESCRIPCIÓN DEL TRABAJO DE OFICINA

De acuerdo a los planos arquitectónicos y visitas realizadas en campo se procedió al desarrollo del estudio y análisis estructural con la ayuda de diferentes programas tales como ETABS v9.7.4, el cual tiene en cuenta los efectos de segundo orden. Por otro lado se siguieron las recomendaciones descrita en el respectivo estudio de suelos

3 DESCRIPCIÓN DE LOS CRITERIOS BÁSICOS DE DISEÑO

El proyecto se soluciona mediante el diseño de una estructura aporticada en concreto, con placa maciza y vigas descolgadas. Se manejan luces que varían entre 2.00m y 6.00m en los dos sentidos de la estructura.

4 NORMAS Y CÓDIGOS A LOS CUALES SE CIÑEN LOS DISEÑOS

El diseño de todas las estructuras se realizó basado en la Norma Colombiana de Diseño y Construcción Sismo Resistente Ley 400 de 1997 (Modificada Ley 1229 de 2008) y Decreto 926 de Marzo de 2010, Decreto 092 del 17 de Enero de 2011, Decreto 0340 del 13 de Febrero de 2012 y en el Reglamento para Concreto Estructural ACI 318S-08.

5 DESCRIPCIÓN DE LA METODOLOGÍA DE DISEÑO EMPLEADA.

El proyecto se soluciona mediante el diseño de una estructura aporticada en concreto, con placa maciza y vigas descolgadas. Se manejan luces que varían entre 2.00m y 6.00m en los dos sentidos de la estructura.

Las cargas horizontales fueron distribuidas entre los diferentes pórticos en proporción a su rigidez y teniendo en cuenta los efectos de torsión.

El dimensionamiento dado a todos los elementos que intervienen en las estructuras satisfacen los requerimientos de solicitación ocasionados por las derivas presentes. Las cargas vivas de diseño son: **5.00 kN/ m²** para placa maciza.

Para la cimentación se siguieron las recomendaciones descritas en el respectivo estudio de suelos, que recomienda apoyar la estructura a **-1.50 m** del nivel de la placa aérea de cimentación, apoyando las zapatas a **-1.50 m**, según lo indicado en los planos estructurales. La capacidad portante de seguridad admisible del suelo es **0.12 MPa** y el tipo de suelo es **E**.

6 DESCRIPCIÓN Y ANÁLISIS DE LAS CONDICIONES EXISTENTES

El sitio donde se procederá a la construcción de la estructura se encuentra ubicado una edificación existente, como se evidenciara en las fotos mostradas a continuación.

1Fotografía Estructura existente

Fuente: Propia

2Fotografía Estructura existente

Fuente: Propia

3 Fotografía Estructura existente

Fuente: Propia

4 Fotografía Estructura existente

Fuente: Propia

MEMORIAL DE RESPONSABILIDAD

JAMUNDÌ, Agosto de 2017.

Señores

PLANEACION MUNICIPAL
La Ciudad

Yo, **EDGAR ROLANDO BARRERA,** ingeniero civil con Matrícula Profesional Nº **15202-102710** de **BOYACÁ,** debidamente registrado en el consejo profesional de Ingeniería y Arquitectura de Boyacá, presento los cálculos y diseños estructurales elaborados de acuerdo a los requerimientos de la **NORMA COLOMBIANA DE DISEÑO Y CONSTRUCCIÓN SISMO RESISTENTE LEY 400 DE 1997 (MODIFICADA LEY 1229 DE 2008) Y DECRETO 926 DE MARZO DE 2010**, para el proyecto **JORNADA ÚNICA DEL MINISTERIO DE EDUCACIÓN- MODULO 2. INSTITUCIÓN EDUCATIVA ALFREDO BONILLA SEDE No. 2 MARIA INMAULADA**, declaro que asumo la responsabilidad por los perjuicios que causa de ellos puedan deducirse, exonerando a la PLANEACION MUNICIPAL de cualquier responsabilidad.

Acepto y reconozco que la revisión efectuada por PLANEACION URBANA no constituye una aprobación al Diseño Estructural, sino una verificación del cumplimiento de la **NORMA COLOMBIANA DE DISEÑO Y CONSTRUCCIÓN SISMO RESISTENTE**.

Atentamente,

____

EDGAR ROLANDO BARRERA

ING. ESTRUCTURAL

T.P. 15202-102710 BYC


REPUBLICA DE COLOMBIA
CONSEJO PROFESIONAL NACIONAL DE INGENIERIA
Y SUS PROFESIONES AUXILIARES
INGENIERO CIVIL
BARRERA SALINAS
EDGAR ROLANDO
UNIVERSIDAD PEDAGOGICA Y
TECNOLOGICA DE COLOMBIA
PRESIDENTE DEL CONSEJO

7 MEMORIA DE CÁLCULO

7.1 AVALUO DE CARGAS

AVALUO DE CARGAS RAMPA PEATONAL

1. PLACA MACIZA RAMPA

Placa Maciza e=0.10m	0.10x24		2,40 kN/m²
Barandas			1,00 kN/m²
Impermeabilización	20x0.05		1,00 kN/m²
		CM	4,40 kN/m²
		CV	5,00 kN/m²
		CR	9,40 kN/m²

CU = 1.2x4.4+1.6x5 = ***13,3 kN/m²***

Espesor de placa equivalente:

e=CM/24 0,183 m

7.2 ANALISIS SISMICO

7.2.1 ANÁLISIS SÍSMICO (ESPECTRO DE DISEÑO NSR-10)

ANÁLISIS SÍSMICO (ESPECTRO DE DISEÑO NSR-10)

ZONA DE AMENAZA SÍSMICA
ALTA

EFECTOS LOCALES

Perfil de Suelo	E
Coeficiente Aa	0,25
Coeficiente Av	0,25

COEFICIENTE DE IMPORTANCIA

Grupo de Uso	III
Coeficiente de importancia I	1,25

PERIODO FUNDAMENTAL DE LA EDIFICACIÓN

$T_a = C_t h^{\alpha}$		
C_t =	0,047	
h =	3,50	m
α =	0,90	
T_a=	0,15	Seg

VARIACIÓN COEFICIENTE DE CAPACIDAD DE DISIPACIÓN DE ENERGÍA

Ro: Coeficiente de capacidad de disipación de energía básico

R: Coeficiente de capacidad de disipación de energía, para ser empleado en el diseño.

ϕ_a: Coeficiente de reducción de R causado por irregularidades en altura de la edificación

ϕ_p: Coeficiente de reducción de R causado por irregularidades en planta de la edificación

ϕ_r: Coeficiente de reducción de R causado por ausencia de redundancia en el sistema estructural de resistencia sísmica

Ro	1,50
ϕ_a	1,00
ϕ_p	1,00
ϕ_r	1,00
ϕ	1,00
R	1,50

TIPO	DESCRIPCIÓN	VALOR
		ϕ_P: 1.00
		ϕ_a: 1.00
		ϕ_r: 1.00
	UNIONES SOLDADAS	ϕ: 1.00

ESPECTRO DE DISEÑO (AMORTIGUAMIENTO ξ=5% DEL CRÍTICO)

Fa: Factor de ampliación de la aceleración.
Fv: Factor de ampliación de la aceleración en el rango de velocidades constantes.
Sa: Valor del espectro de aceleraciones de diseño para un periodo de vibración dado.
Aa: Coeficiente que representa la aceleración horizontal pico efectiva para diseño.
Av: Coeficiente que representa la velocidad horizontal pico efectiva para diseño.
T: Periodo de vibración del sistema elástico, en segundos.
T_C: Periodo de vibración, en segundos, correspondiente a la transición entre la zona de aceleración constante del espectro de diseño, para periodos cortos, y la parte descendiente del mismo.
T_L: Periodo de vibración, en segundos, correspondiente al inicio de la zona de desplazamiento aproximadamente constante del espectro de diseño para periodos largos.

ZONA DE AMENAZA ALTA

T_o:	0,21	Seg
T_C:	0,99	Seg
T_L:	7,20	Seg
Aa:	0,25	
Av:	0,25	
Fa:	1,45	
Fv:	3,00	

T	Sa	Sa/$R_{adoptado}$
(Seg)	(%g)	(%g)
0,00	1,133	0,755
0,05	1,133	0,755
0,10	1,133	0,755
0,16	1,133	0,755
0,21	1,133	0,755
0,40	1,133	0,755
0,60	1,133	0,755
0,80	1,133	0,755
0,99	1,133	0,755
1,34	0,841	0,561
1,68	0,669	0,446
2,03	0,555	0,370
2,37	0,474	0,316
2,72	0,414	0,276
3,06	0,367	0,245
3,41	0,330	0,220
3,75	0,300	0,200
4,10	0,275	0,183
4,44	0,253	0,169
4,79	0,235	0,157
5,13	0,219	0,146
5,48	0,205	0,137
5,82	0,193	0,129
6,17	0,182	0,122
6,51	0,173	0,115
6,86	0,164	0,109
7,20	0,156	0,104
8,20	0,120	0,080
9,20	0,096	0,064

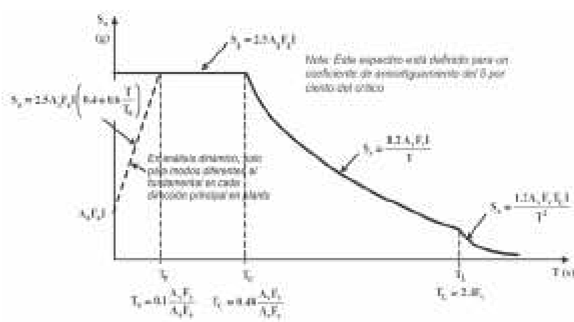
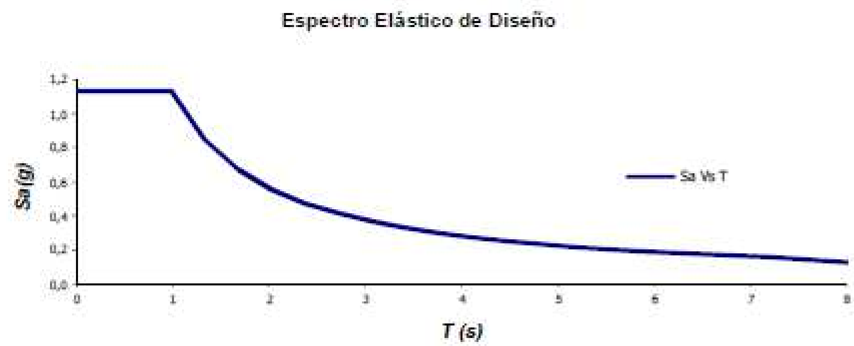
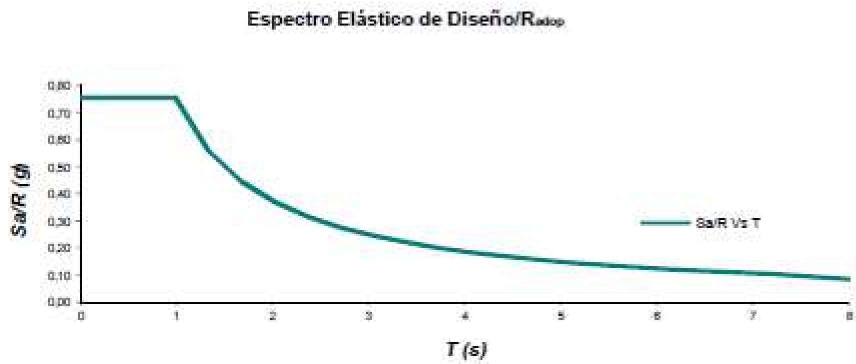


Figura A.2.6-1 — Espectro Elástico de Aceleraciones de Diseño como fracción de ξ





Sistema de resistencia Sísmica: Pórticos resistentes a momentos con Capacidad Especial de Disipación de Energía (DES).

Nota: El sistema de pórtico es un sistema estructural compuesto por un pórtico espacial, resistente a momentos, esencialmente completo, sin diagonales, que resiste todas las cargas verticales y las fuerzas horizontales.

MODELO MATEMÁTICO

Modelo Tridimensional con Diafragma Rígido: En este modelo los entrepisos se consideran diafragmas infinitamente rigidos en su propio plano. La masa de cada diafragma se considera concentrada en su centro de masa. Los efectos torsionales accidentales son incluidos haciendo ajustes en la localización de los centros de masa de los diafragmas.
Los efectos direccionales son tomados en cuenta a través de las componentes de los desplazamientos de los grados de libertad horizontales ortogonales del diafragma.

7.2.2 ANÁLISIS SÍSMICO (ESPECTRO DE UMBRAL DE DAÑO NSR-10)

ANÁLISIS SÍSMICO (ESPECTRO DE UMBRAL DE DAÑO NSR-10)

ZONA DE AMENAZA SÍSMICA
ALTA

EFECTOS LOCALES

Perfil de Suelo	E
Coeficiente Ad	0,09
Coeficiente Fv	3,50

COEFICIENTE DE IMPORTANCIA

Grupo de Uso	III
Coeficiente de importancia I	1,25
Coeficiente de Sitio Ŝ:	4,38

ESPECTRO DE UMBRAL DE DAÑO (AMORTIGUAMIENTO ξ=2% DEL CRÍTICO)

Sad: Valor del espectro de aceleraciones del umbral de daño para un periodo de vibración dado.
Ad: Máxima aceleración pico efectiva para el umbral de daño.
T: Periodo de vibración del sistema elástico, en segundos.
T_{Cd}: Periodo de vibración, en segundos, correspondiente a la transición entre la zona de aceleración constante del espectro sísmico del umbral de daño, para periodos cortos, y la parte descendiente del mismo.
T_{Ld}: Periodo de vibración, en segundos, correspondiente a la transición entre la zona de desplazamiento constante del espectro sísmico del umbral de daño, para periodos largos.

Ad: 0,09
T_{Cd}: 2,19 Seg
T_{Ld}: 10,5 Seg

T (Seg)	Sad (%g)
0,00	0,090
0,05	0,126
0,10	0,162
0,15	0,198
0,20	0,234
0,25	0,270
0,49	0,270
0,73	0,270
0,98	0,270
1,22	0,270
1,46	0,270

1,70	0,270
1,95	0,270
2,19	0,270
2,78	0,212
3,38	0,175
3,97	0,149
4,56	0,129
5,16	0,115
5,75	0,103
6,34	0,093
6,94	0,085
7,53	0,078
8,13	0,073
8,72	0,068
9,31	0,063
9,91	0,060
10,50	0,056
11,50	0,047
12,50	0,040

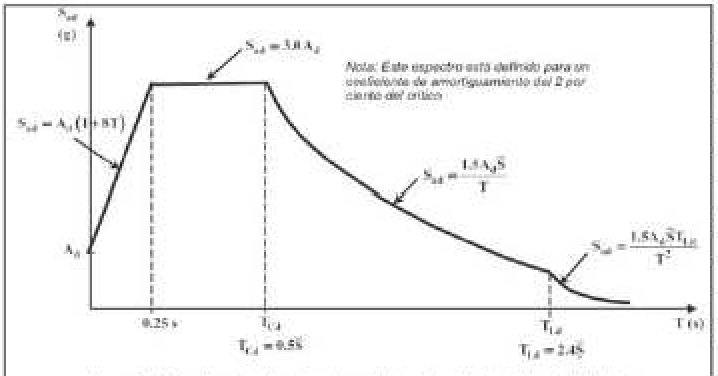
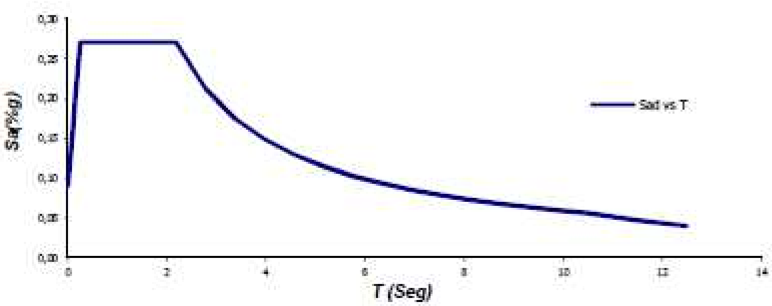


Figura A.12.3-1 — Espectro de aceleraciones horizontales elástico del umbral de daño

Espectro Del Umbral de Daño



Sistema de resistencia Sísmica: Pórticos resistentes a momentos con Capacidad Especial de Disipación de Energía (DES).

Nota: El sistema de pórtico es un sistema estructural compuesto por un pórtico espacial, resistente a momentos, esencialmente completo, sin diagonales, que resiste todas las cargas verticales y las fuerzas horizontales.

MODELO MATEMÁTICO

Modelo Tridimensional con Diafragma Rígido: En este modelo los entrepisos se consideran diafragmas infinitamente rigidos en su propio plano. La masa de cada diafragma se considera concentrada en su centro de masa. Los efectos torsionales accidentales son incluidos haciendo ajustes en la localización de los centros de masa de los diafragmas.
Los efectos direccionales son tomados en cuenta a través de las componentes de los desplazamientos de los grados de libertad horizontales ortogonales del diafragma.

7.2.3 CALCULO DEL CORTANTE BASAL DE LA ESTRUCTURA (ESPECTRO DE DISEÑO NSR-10)

CALCULO DEL CORTANTE BASAL DE LA ESTRUCTURA (ESPECTRO DE DISEÑO NSR-10)

CALCULO DEL CORTANTE BASAL DE LA ESTRUCTURA

$H_{edificio}$ =	3.50	m	
Tipo de Perfil:	E		
Aa =	0.25		
Av =	0.25		
Fa =	1.45		
Fv =	3.00		
T_c =	0.99	Seg	
C_t =	0.047		
α =	0.90		
T_a =	0.15	Seg	
C_u =	1.20		
$C_u T_a$ =	0.17	Seg	
$T_{modelación\ estructural}$ =	0.15	Seg	
ΔT =	3.36	%	Ok!
$T_{adoptado}$ =	0.15	Seg	
S_a =	1.133		S_a obtenido del espectro de diseño
g =	9.81	m/s^2	
M =	35.46	Ton	Masa obtenida del modelo
V_s =	394.13	kN	
90% Vs =	354.72	kN	Cortante basal para comparación de acuerdo a A.5.4.5 NSR-

MODELO INICIAL
Response Espectrum Base Reactions

PORCENTAJE PARA REVISIÓN DE CORTANTE BASAL DE ACUERDO A A.5.4.5 NSR-10: 90.0 %

	F1	F2	Total	Factor		g corregido
$V_{s\,(x)}$=	216.65	0	216.65	1.637	16.062	Se aplica e
$V_{s\,(y)}$=	0	201.16	201.16	1.763	17.298	Se aplica e

MODELO CORREGIDO
Response Espectrum Base Reactions

	F1	F2	Total	90% Vs
$V_{s\,(x)}$=	354.73	0	354.73	354.7
$V_{s\,(y)}$=	0	354.7	354.70	354.7

7.2.4 CALCULO DEL CORTANTE BASAL DE LA ESTRUCTURA (ESPECTRO DE UMBRAL DE DAÑO NSR-10)

CALCULO DEL CORTANTE BASAL DE LA ESTRUCTURA (ESPECTRO DE UMBRAL DE DAÑO NSR-10)

CALCULO DEL CORTANTE BASAL DE LA ESTRUCTURA

$H_{edificio}$ =	3.50	m	
Tipo de Perfil:	E		
Ad =	0.09		
Fv =	0.40		
C_t =	0.047		
α =	0.90		
T_a =	0.15	Seg	
C_u =	1.20		
C_uT_a =	0.17	Seg	
$T_{modelación\ estructural}$ =	0.15	Seg	
ΔT =	3.36	%	Ok!
$T_{adoptado}$ =	0.15	Seg	
S_a =	0.270		S_a obtenido del espectro de diseño
g =	9.81	m/s^2	
M =	35.46	Ton	Masa obtenida del modelo
V_s =	93.92	kN	

MODELO INICIAL
Response Espectrum Base Reactions

PORCENTAJE PARA REVISIÓN DE CORTANTE BASAL DE ACUERDO A A.5.4.5 NSR-10: 100.

	F1	F2	Total	Factor		g corre
$V_{s(x)}$ =	26.92	0	26.92	3.489	34.227	Se apl:
$V_{s(y)}$ =	0	32.28	32.28	2.910	28.543	Se apl:

MODELO CORREGIDO
Response Espectrum Base Reactions

	F1	F2	Total	100% Vs
$V_{s(x)}$ =	93.91	0	93.91	93.9
$V_{s(y)}$ =	0	93.92	93.92	93.9

7.3 DISEÑO DE CIMENTACIÓN

7.3.1 ELECCIÓN DE CARGAS PARA DISEÑO DE CIMENTACIÓN

ELECCIÓN DE CARGAS Y DIMENSIONES PARA DISEÑO DE CIMENTACIÓN

COMBINACIONES DE CARGA

Cargas Gravitacionales: CIMEN= 1D + 1L

Cargas por Estado Limite de Servicio CIMEN2= 1D + 0.75L + 0.70*(0.75/R)Ex + 0.21*(0.75/R)Ey

CIMEN3= 1D + 0.75L + 0.21*(0.75/R)Ex + 0.70*(0.75/R)Ey

NSR-10	F.S.	CAPACIDAD PORTANTE (MPa)
B.2.3-2	3.00	0.12
B.2.3-8	1.50	0.24

$$\sigma_c = \frac{P}{B.L} \pm \frac{6.M_x}{B.L^2} \pm \frac{6.M_y}{L.B^2}$$

										TIPO DE	DIMENSIONES CIMIENTO		ESFUERZOS EN EL SUELO (MPa)						CONDICIÓN CRÍTICA?	
Story	Point	Load	FX	FY	FZ	MX	MY	MZ	Load	ZAPATA	ANCHO X (m)	LARGO Y (m)	σ_1	σ_2	σ_3	σ_4	$\sigma_{máx}$	CUMPLE?	Load	$\sigma_{máx}$
BASE	619	CIMEN	0.4	-0.1	355.8	-7.1	-5.4	24.3	CIMEN	1	2.50	2.50	0.06	0.06	0.06	0.07	**0.07**	OK!		
BASE	619	CIMEN2 MAX	42.1	52.0	323.8	119.1	36.7	41.9	CIMEN2 MAX	1	2.50	2.50	0.12	0.09	0.03	0.00	**0.12**	OK!		
BASE	619	CIMEN2 MIN	-41.3	-52.1	317.8	-131.5	-46.3	1.6	CIMEN2 MIN	1	2.50	2.50	-0.01	0.02	0.09	0.12	**0.12**	OK!	CIMEN2 MIN	0.12
BASE	619	CIMEM3 MAX	37.3	51.1	324.1	115.4	26.9	38.9	CIMEM3 MAX	1	2.50	2.50	0.11	0.09	0.02	0.00	**0.11**	OK!		
BASE	619	CIMEM3 MIN	-36.5	-51.1	317.5	-127.9	-36.5	4.7	CIMEM3 MIN	1	2.50	2.50	-0.01	0.02	0.09	0.12	**0.12**	OK!		
BASE	620	CIMEN	5.6	0.7	182.1	194.1	43.0	8.8	CIMEN	2	2.60	2.60	0.11	0.08	-0.02	-0.05	**0.11**	OK!		
BASE	620	CIMEN2 MAX	19.9	24.6	173.5	252.0	69.7	27.3	CIMEN2 MAX	2	2.60	2.60	0.14	0.09	-0.03	-0.08	**0.14**	OK!		
BASE	620	CIMEN2 MIN	-7.7	-23.4	161.2	100.4	8.5	-11.5	CIMEN2 MIN	2	2.60	2.60	0.06	0.06	-0.01	-0.01	**0.06**	OK!	CIMEM3 MAX	0.18
BASE	620	CIMEM3 MAX	16.0	62.2	173.3	374.6	62.2	28.5	CIMEM3 MAX	2	2.60	2.60	0.18	0.13	-0.08	-0.12	**0.18**	OK!		
BASE	620	CIMEM3 MIN	-3.8	-61.0	161.4	-22.2	16.1	-12.7	CIMEM3 MIN	2	2.60	2.60	0.02	0.01	0.04	0.03	**0.04**	OK!		
BASE	621	CIMEN	-16.1	-0.9	403.4	-8.8	-22.3	6.4	CIMEN	3	2.50	2.50	0.06	0.08	0.07	0.08	**0.08**	OK!		
BASE	621	CIMEN2 MAX	36.8	44.6	367.7	76.0	35.3	28.2	CIMEN2 MAX	3	2.50	2.50	0.11	0.08	0.05	0.02	**0.11**	OK!		
BASE	621	CIMEN2 MIN	-64.9	-46.3	357.6	-91.9	-74.5	-16.7	CIMEN2 MIN	3	2.50	2.50	0.00	0.06	0.07	0.13	**0.13**	OK!	CIMEM3 MIN	0.14
BASE	621	CIMEM3 MAX	33.8	70.5	368.9	124.3	29.2	28.6	CIMEM3 MAX	3	2.50	2.50	0.12	0.10	0.03	0.01	**0.12**	OK!		
BASE	621	CIMEM3 MIN	-61.9	-72.1	356.5	-140.1	-68.3	-17.1	CIMEM3 MIN	3	2.50	2.50	-0.02	0.04	0.09	0.14	**0.14**	OK!		
BASE	633	CIMEN	26.2	0.3	328.0	1.3	-2.2	-3.4	CIMEN	3	2.50	2.50	0.06	0.06	0.06	0.06	**0.06**	OK!		
BASE	633	CIMEN2 MAX	68.3	39.0	305.5	60.8	62.4	23.0	CIMEN2 MAX	3	2.50	2.50	0.10	0.05	0.05	0.01	**0.10**	OK!		
BASE	633	CIMEN2 MIN	-24.5	-38.5	286.7	-58.7	-67.0	-29.2	CIMEN2 MIN	3	2.50	2.50	0.00	0.05	0.05	0.10	**0.10**	OK!	CIMEM3 MAX	0.12
BASE	633	CIMEM3 MAX	66.7	68.1	304.0	111.2	60.2	24.3	CIMEM3 MAX	3	2.50	2.50	0.12	0.07	0.03	-0.01	**0.12**	OK!		
BASE	633	CIMEM3 MIN	-22.9	-67.6	288.3	-109.1	-64.8	-30.5	CIMEM3 MIN	3	2.50	2.50	-0.02	0.03	0.07	0.12	**0.12**	OK!		

7.3.2 DISEÑO VIGAS DE AMARRE

DISEÑO VIGAS DE AMARRE

PROYECTO: I. E.ALFREDO BONILLA SEDE No. 2 MARÍA INMACULADA

VIGA DE AMARRE TIPO

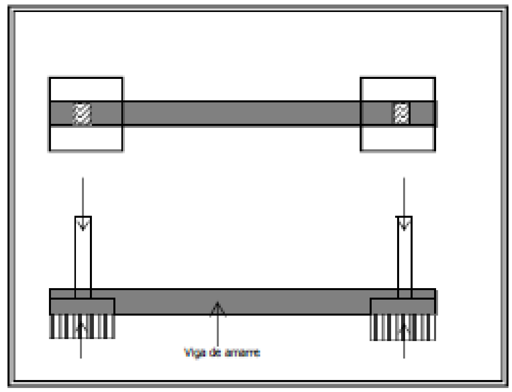
f'c = **21,1** MPa
fy = **420** MPa

b = **0,30** m
h = **0,50** m

Pmáx = ***513,99 kN***

De acuerdo a el numeral A.3.6.4.2 de la NSR-10 tenemos:

Aa = *0,25*
Paxial = 0.25*Aa*Pmáx
Paxial = *32,124* kN



DISEÑO A TENSIÓN

As = 1.7*32.124375/(0.90*420)
As = **1,44** cm^2

DISEÑO A COMPRESIÓN

P com = 1.7*32.124375
P com = *54,6* kN

Para esta carga la sección requiere cuantía mínima:

As = 0.00333*0.3*0.45
As = **4,50** cm^2

Se suministra un refuerzo constituido por 3#4 arriba y abajo (como refuerzo mínimo).

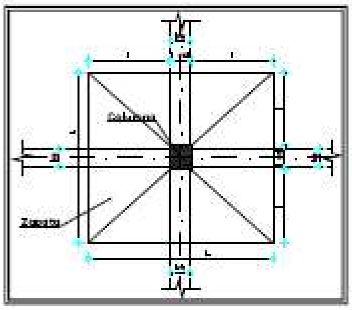
7.3.3 DISEÑO DE ZAPATAS

DISEÑO DE ZAPATAS CONCÉNTRICAS
PROYECTO: I.E MARIA INMACULADA-RAMPA

ZAPATA TIPO 9 (2 Und).

Columna	**b =**	50	cm	**f'c =**	21.0	MPa	**σ DISEÑO =**	0.140	MPa
	t =	50	cm	**fy =**	420.0	MPa			

PREDIMENSIONAMIENTO



L =	2.500	m
lcol =	0.500	m
l =	1.000	m

FACTOR DE MAYORACIÓN = 1.50

Dimensión de cada lado = **2.50** m

Esfuerzos de diseño

σmáx=	0.140	MPa	***OK***
σmín=	0.140	MPa	***OK***

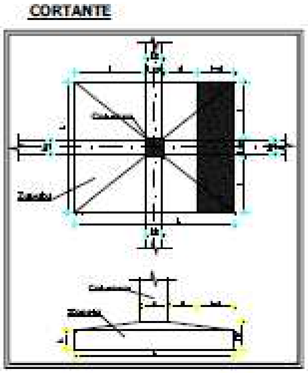
DISEÑO DE ZAPATA CONCÉNTRICA

FLEXIÓN

M borde de la columna = 70.00 kN*m
M mayorado borde de la columna Mu = 105.00 kN*m

Con el criterio de calcular el refuerzo por metro lineal utilizamos una altura efectiva igual a: **d=** **0.43** m
Cuantía = 0.00200
As = 8.60 cm²/m
Armadura: **17#428c./0.15 ambos sentidos**

CORTANTE



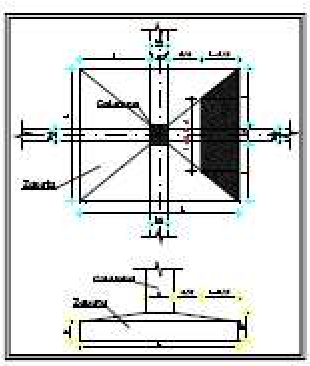
a. En una dirección (d)

L =	2.50	m	**H =**	0.50	m
l =	1.00	m	**h =**	0.30	m
l - d =	0.57	m	**H-h =**	0.20	m

V (d) =	199.50	kN
Vu (d)=	1.7*V(d)	
Vu (d) =	339.15	kN
h´ =	0.35	m

$$uv = \frac{Vu}{L * h'} = 0.388 \text{ MPa}$$

ϕvc = 0.57 MPa ***OK***



b. En dos direcciones (d/2)

ZAPATA TIPO 9 (2 Und).

L =	2.500	m	**H =**	0.50	m
d/2 =	0.215	m	**h =**	0.30	m
l - d/2 =	0.785	m	**H-h =**	0.20	m

V (d/2) =	188.5	kN
Vu (d/2) =	1.5*V(d)	
Vu (d/2) =	282.7	kN
d_1 =	0.39526316	m

$$vu = \frac{Vu}{bo \times d_1} = 0.769 \text{ MPa}$$

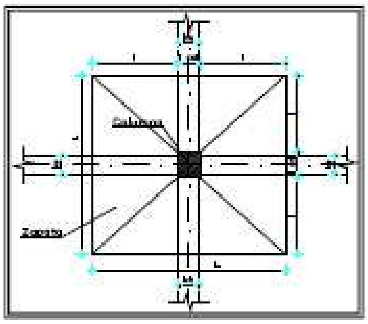
ϕvc= 1.15 MPa ***OK***

DISEÑO DE ZAPATAS CONCÉNTRICAS
PROYECTO: I.E MARIA INMACULADA-RAMPA

ZAPATA TIPO 10 (1 Und).

Columna	b =	50	cm	f'c =	21.0	MPa	$\sigma_{DISEÑO}$=	0.120	MPa
	t =	50	cm	fy =	420.0	MPa			

PREDIMENSIONAMIENTO



L =	2.100	m
lcol =	0.500	m
l =	0.800	m

FACTOR DE MAYORACIÓN = 1.50

Dimensión de cada lado = **2.10** m

Esfuerzos de diseño

σmáx=	0.120	MPa	***OK***
σmin=	0.120	MPa	***OK***

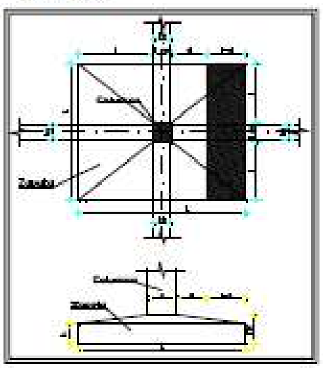
DISEÑO DE ZAPATA CONCÉNTRICA

FLEXIÓN

M borde de la columna = 38.40 kN*m
M mayorado borde de la columna Mu = 57.60 kN*m

Con el criterio de calcular el refuerzo por metro lineal utilizamos una altura efectiva igual a: **d= 0.33** m
Cuantia = 0.00200
As = 6.60 cm²/m
Armadura: **12#424c./0.19**
ambos sentidos

CORTANTE



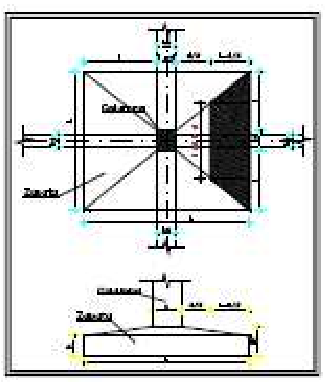
a. En una dirección (d)

L =	2.10	m		**H =**	0.40	m
l =	0.80	m		**h =**	0.30	m
l - d =	0.47	m		**H-h =**	0.10	m

V (d) =	118.44	kN
Vu (d)=	1.7*V(d)	
Vu (d) =	201.35	kN
h´ =	0.29	m

$$\upsilon v = \frac{Vu}{L * h´} = 0.328 \text{ MPa}$$

ϕvc = 0.57 MPa ***OK***



b. En dos direcciones (d/2)

ZAPATA TIPO 10 (1 Und)

L =	2.100	m		**H =**	0.40	m
d/2 =	0.165	m		**h =**	0.30	m
l - d/2 =	0.635	m		**H-h =**	0.10	m

V (d/2) =	111.6	kN
Vu (d/2) =	1.5*V(d)	
Vu (d/2) =	167.4	kN
d_1 =	0.31466667	m

$$vu = \frac{Vu}{bo \times d_1} = 0.641 \text{ MPa}$$

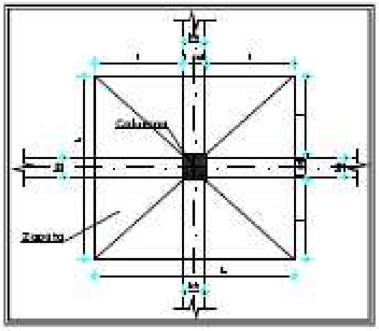
ϕvc= 1.15 MPa ***OK***

DISEÑO DE ZAPATAS CONCÉNTRICAS
PROYECTO: I.E MARIA INMACULADA-RAMPA

ZAPATA TIPO 11 (1 Und).

Columna	b =	50	cm	f'c =	21.0	MPa	$\sigma_{DISEÑO}$ =	0.180	MPa
	t =	50	cm	fy =	420.0	MPa			

PREDIMENSIONAMIENTO



L =	2.600	m
lcol =	0.500	m
l =	1.050	m

FACTOR DE MAYORACIÓN = 1.50

Dimensión de cada lado = **2.60** m

Esfuerzos de diseño			
$\sigma_{máx}$=	0.180	MPa	***OK***
$\sigma_{mín}$=	0.180	MPa	***OK***

DISEÑO DE ZAPATA CONCÉNTRICA

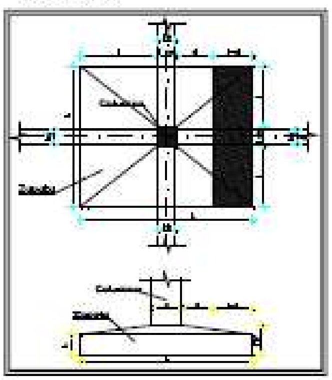
FLEXIÓN

M borde de la columna = 99.23 kN*m
M mayorado borde de la columna Mu = 148.84 kN*m

Con el criterio de calcular el refuerzo por metro lineal utilizamos una altura efectiva igual a: **d= 0.53** m

Cuantia = 0.00200
As = 10.60 cm²/m
Armadura: **15#5@c./0.18**
ambos sentidos

CORTANTE



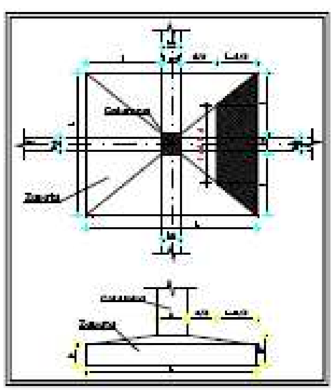
a. En una dirección (d)

L =	2.60	m	H =	0.60	m
l =	1.05	m	h =	0.30	m
l - d =	0.52	m	H-h =	0.30	m

V (d) = 243.36 kN
Vu (d)= 1.7*V(d)
Vu (d) = 413.71 kN
h´ = 0.39 m

$$uv = \frac{Vu}{L * h'} = 0.412 \text{ MPa}$$

ϕvc = 0.57 MPa ***OK***



b. En dos direcciones (d/2)

ZAPATA TIPO 11 (1 Und)

L =	2.600	m	H =	0.60	m
d/2 =	0.265	m	h =	0.30	m
l - d/2 =	0.785	m	H-h =	0.30	m

V (d/2) = 256.5 kN
Vu (d/2) = 1.5*V(d)
Vu (d/2) = 384.7 kN
d_1 = 0.4655 m

$$vu = \frac{Vu}{bo \times d_1} = 0.802 \text{ MPa}$$

ϕvc= 1.15 MPa ***OK***

7.4 DISEÑO DE VIGAS Y COLUMNAS

7.4.1 VIGAS

VR-016/BASE

B=0.40 H=0.40 L=1.90		
Mu=-3.21 As =0.00 As(r)=4.57		Mu=-2.01 As =5.08 As(r)=4.57
	Mu=1.31 As =5.08 As(r)=4.57	
Vu=-6.30	Vu=-1.12	Vu=-6.96

VR-012/N+0.5

B=0.15 H=0.45 L=1.88		
Mu=-0.99 As =1.90 As(r)=1.96		Mu=-3.94 As =2.54 As(r)=1.96
	Mu=3.30 As =2.54 As(r)=1.96	
Vu=-6.97	Vu=2.03	Vu=10.26

VR-014/N+0.5

B=0.40 H=0.45 L=2.04		
Mu=-4.89 As =0.00 As(r)=5.23		Mu=-358.70 As =29.04 As(r)=30.16
	Mu=0.00 As =11.40 As(r)=5.23	
Vu=120.85	Vu=134.61	Vu=291.93

VR-010/N+1.08

B=0.40 H=0.45 L=2.10		
Mu=-6.45 As =0.00 As(r)=5.23		Mu=-423.98 As =33.42 As(r)=34.22
	Mu=0.00 As =20.28 As(r)=5.23	
Vu=143.17	Vu=156.93	Vu=339.23

VR-08/N+1.08

B=0.15 H=0.45 L=1.80		
Mu=-1.76 As =1.90 As(r)=1.96		Mu=-7.06 As =2.54 As(r)=1.96
	Mu=2.22 As =2.54 As(r)=1.96	
Vu=-5.24	Vu=3.71	Vu=11.99

VR-04/N+1.68

B=0.15 H=0.45 L=2.05			B=0.15 H=0.45 L=5.90			B=0.15 H=0.45 L=1.65		
Mu=-0.00 As =0.00 As(r)=1.96		Mu=-59.27 As =7.76 As(r)=4.33	Mu=-72.68 As =7.76 As(r)=5.44		Mu=-18.17 As =10.14 As(r)=1.96	Mu=-28.37 As =10.14 As(r)=1.97		Mu=-113.47 As =10.14 As(r)=10.00
	Mu=0.00 As =3.96 As(r)=1.96			Mu=40.24 As =3.96 As(r)=3.23			Mu=28.37 As =3.96 As(r)=2.84	
Vu=15.84	Vu=27.94	Vu=40.03	Vu=59.89	Vu=12.85	Vu=-34.19	Vu=66.35	Vu=72.85	Vu=79.35

B=0.15 H=0.45 L=5.85			B=0.15 H=0.45 L=1.65			B=0.15 H=0.45 L=5.70		
Mu=-83.71 As =10.14 As(r)=6.40		Mu=-20.93 As =7.76 As(r)=1.96	Mu=-24.83 As =7.76 As(r)=1.96		Mu=-99.31 As =7.76 As(r)=7.86	Mu=-53.75 As =7.76 As(r)=3.89		Mu=-38.92 As =5.70 As(r)=2.75
	Mu=41.86 As =3.96 As(r)=3.12			Mu=24.83 As =3.96 As(r)=2.14			Mu=24.76 As =3.96 As(r)=1.96	
Vu=62.48	Vu=15.44	Vu=-31.60	Vu=61.30	Vu=67.80	Vu=74.31	Vu=48.85	Vu=2.55	Vu=-44.01

VR-05/N+1.68

B=0.15 H=0.45 L=2.05			B=0.15 H=0.45 L=5.90			B=0.15 H=0.45 L=1.65		
Mu=-3.72 As =0.00 As(r)=1.96		Mu=-36.97 As =5.70 As(r)=2.60	Mu=-65.36 As =5.70 As(r)=4.83		Mu=-16.34 As =7.76 As(r)=1.96	Mu=-24.38 As =7.76 As(r)=1.96		Mu=-97.53 As =7.76 As(r)=7.69
	Mu=0.00 As =3.96 As(r)=1.96			Mu=45.34 As =3.96 As(r)=3.59			Mu=24.38 As =3.96 As(r)=2.10	
Vu=3.10	Vu=14.77	Vu=26.63	Vu=59.18	Vu=12.13	Vu=-34.91	Vu=60.36	Vu=66.86	Vu=73.37

B=0.15 H=0.45 L=5.85			B=0.15 H=0.45 L=1.65			B=0.15 H=0.45 L=5.70		
Mu=-90.58 As =7.76 As(r)=7.03		Mu=-22.64 As =5.70 As(r)=1.96	Mu=-18.97 As =5.70 As(r)=1.96		Mu=-75.87 As =5.70 As(r)=5.72	Mu=-54.01 As =5.70 As(r)=3.91		Mu=-31.53 As =3.96 As(r)=2.20
	Mu=45.29 As =3.96 As(r)=3.23			Mu=18.97 As =3.96 As(r)=1.96			Mu=28.33 As =3.96 As(r)=1.97	
Vu=64.46	Vu=17.42	Vu=-29.62	Vu=51.98	Vu=58.48	Vu=64.99	Vu=50.10	Vu=4.65	Vu=-42.76

VR-06/N+1.68

B=0.15 H=0.45 L=4.28		
Mu=-4.54 As =1.90 As(r)=1.96		Mu=-5.60 As =2.54 As(r)=1.96
	Mu=4.35 As =2.54 As(r)=1.96	
Vu=-3.10	Vu=-13.47	Vu=2.74

VR-07/N+1.68

B=0.40 H=0.45 L=1.92			B=0.40 H=0.45 L=1.86		
Mu=-2.36 As =20.24 As(r)=5.23		Mu=-247.97 As =26.98 As(r)=19.35	Mu=-311.51 As =26.98 As(r)=27.22		Mu=-5.97 As =26.98 As(r)=5.23
	Mu=0.00 As =7.92 As(r)=5.23			Mu=0.00 As =7.92 As(r)=5.23	
Vu=77.56	Vu=91.62	Vu=251.07	Vu=-254.86	Vu=-121.36	Vu=-108.00

VR-011/N+2.26

B=0.40 H=0.45 L=2.10		
Mu=-395.08 As =33.42 As(r)=32.43		Mu=-6.91 As =0.00 As(r)=5.23
	Mu=0.00 As =15.52 As(r)=8.88	
Vu=325.92	Vu=150.31	Vu=137.12

VR-09/N+2.26

B=0.15 H=0.45 L=1.80		
Mu=-4.80 As =1.90 As(r)=1.96		Mu=-1.82 As =2.54 As(r)=1.96
	Mu=1.91 As =2.54 As(r)=1.96	
Vu=-9.77	Vu=-2.10	Vu=6.46

VR-013/N+2.86

B=0.15 H=0.45 L=1.80		
Mu=-3.86 As =1.90 As(r)=1.96		Mu=-1.51 As =2.54 As(r)=1.96
	Mu=2.90 As =2.54 As(r)=1.96	
Vu=-9.60	Vu=-2.26	Vu=6.63

VR-015/N+2.86

B=0.40 H=0.45 L=2.00		
Mu=-346.93 As =29.04 As(r)=29.43		Mu=-5.99 As =0.00 As(r)=5.23
	Mu=0.00 As =11.40 As(r)=6.07	
Vu=-284.60	Vu=-129.83	Vu=-116.64

VR-01/N+3.5

B=0.15 H=0.45 L=1.76		
Mu=-8.78 As =2.54 As(r)=1.96		Mu=-2.34 As =2.54 As(r)=1.96
	Mu=2.19 As =2.54 As(r)=1.96	
Vu=-8.42	Vu=-3.17	Vu=2.44

VR-017/N+3.5

B=0.40 H=0.45 L=1.85			B=0.40 H=0.45 L=0.34		
Mu=-261.73 As =20.28 As(r)=20.65		Mu=-65.43 As =20.28 As(r)=5.23	Mu=-261.73 As =20.28 As(r)=20.65		Mu=-0.00 As =20.28 As(r)=5.23
	Mu=65.43 As =11.40 As(r)=5.64			Mu=0.00 As =11.40 As(r)=5.23	
Vu=189.44	Vu=96.25	Vu=8.42	Vu=189.44	Vu=96.25	Vu=8.42

VR-018/N+3.5

B=0.15 H=0.45 L=1.85			B=0.15 H=0.45 L=0.34		
Mu=-29.09 As =2.54 As(r)=2.02		Mu=-7.27 As =2.54 As(r)=1.96	Mu=-29.09 As =2.54 As(r)=2.02		Mu=-1.99 As =2.54 As(r)=1.96
	Mu=7.27 As =2.54 As(r)=1.96			Mu=0.00 As =2.54 As(r)=1.96	
Vu=-20.62	Vu=-6.62	Vu=-2.44	Vu=-20.62	Vu=-6.62	Vu=-2.44

VR-019/N+3.5

B=0.40 H=0.45 L=1.75		
Mu=-65.57 As =7.92 As(r)=5.23		Mu=-0.00 As =0.00 As(r)=5.23
	Mu=0.00 As =5.08 As(r)=5.23	
Vu=-44.82	Vu=-32.72	Vu=-20.62

VR-02/N+3.5

B=0.15 H=0.45 L=2.05			B=0.15 H=0.45 L=5.90			B=0.15 H=0.45 L=1.65		
Mu=-4.40 As =0.00 As(r)=1.96		Mu=-36.28 As =5.70 As(r)=2.55	Mu=-70.70 As =5.70 As(r)=5.27		Mu=-17.67 As =7.76 As(r)=1.96	Mu=-21.72 As =7.76 As(r)=1.96		Mu=-86.87 As =7.76 As(r)=6.69
	Mu=0.00 As =3.96 As(r)=1.96			Mu=41.75 As =3.96 As(r)=3.34			Mu=21.72 As =3.96 As(r)=1.96	
Vu=2.74	Vu=14.17	Vu=25.95	Vu=-59.75	Vu=-12.93	Vu=34.33	Vu=53.76	Vu=60.26	Vu=66.76

B=0.15 H=0.45 L=5.85			B=0.15 H=0.45 L=1.65			B=0.15 H=0.45 L=5.70		
Mu=-88.73 As =7.76 As(r)=6.86		Mu=-22.18 As =7.76 As(r)=1.96	Mu=-20.65 As =7.76 As(r)=1.96		Mu=-82.62 As =7.76 As(r)=6.31	Mu=-60.56 As =7.76 As(r)=4.44		Mu=-41.82 As =5.70 As(r)=2.97
	Mu=44.36 As =3.96 As(r)=3.19			Mu=20.65 As =3.96 As(r)=1.96			Mu=20.01 As =3.96 As(r)=1.96	
Vu=-64.06	Vu=-18.26	Vu=30.03	Vu=60.57	Vu=67.08	Vu=73.58	Vu=-49.49	Vu=-4.07	Vu=43.38

B=0.15 H=0.45 L=1.75		
Mu=-30.24 As =5.70 As(r)=2.11		Mu=-0.00 As =0.00 As(r)=1.96
	Mu=0.00 As =3.96 As(r)=1.96	
Vu=-27.71	Vu=-15.63	Vu=-3.77

VR-03/N+3.5

B=0.15 H=0.45 L=2.05			B=0.15 H=0.45 L=5.90			B=0.15 H=0.45 L=1.65		
Mu=-0.00 As =0.00 As(r)=1.96		Mu=-61.43 As =7.76 As(r)=4.51	Mu=-74.68 As =7.76 As(r)=5.61		Mu=-18.67 As =10.14 As(r)=1.96	Mu=-29.17 As =10.14 As(r)=2.03		Mu=-116.69 As =10.14 As(r)=10.20
	Mu=0.00 As =3.96 As(r)=1.96			Mu=39.89 As =3.96 As(r)=3.23			Mu=29.17 As =3.96 As(r)=3.08	
Vu=17.26	Vu=29.32	Vu=41.39	Vu=-60.44	Vu=-13.42	Vu=33.65	Vu=70.20	Vu=76.71	Vu=83.21

B=0.15 H=0.45 L=5.85			B=0.15 H=0.45 L=1.65			B=0.15 H=0.45 L=5.70		
Mu=-82.82 As =10.14 As(r)=6.33		Mu=-20.70 As =10.14 As(r)=1.96	Mu=-27.76 As =10.14 As(r)=1.96		Mu=-111.03 As =10.14 As(r)=9.03	Mu=-45.25 As =10.14 As(r)=3.23		Mu=-52.78 As =0.00 As(r)=3.81
	Mu=41.41 As =3.96 As(r)=3.11			Mu=27.76 As =3.96 As(r)=2.42			Mu=22.19 As =3.96 As(r)=1.96	
Vu=-62.18	Vu=-15.14	Vu=31.90	Vu=69.59	Vu=76.09	Vu=82.59	Vu=-45.21	Vu=4.05	Vu=47.66

7.4.2 COLUMNAS

Columna B'1-6

Nivel	H Libre	Losa	B	H	M1	M2	P	V1	V2	Cuantia	m/mr	Col/Vig Eje ppal	Col/vig Eje sec
N+2.26					1.05	360.04				12/#7 #8 (2.1%)	1.08		1.24
	.73	.45	.50	.50			-281.42	107.63	114.64				
					52.73	477.76				12/#7 #8 (2.1%)	1.21		
N+1.08					25.27	134.64				12/#7 #8 (2.1%)	0.73		2.50
	.68	.45	.50	.50			-573.46	136.28	217.30				
		1.50			137.85	337.64				12/#7 #8 (2.1%)	1.01		

Columna B'1-7

Nivel	H Libre	Losa	B	H	M1	M2	P	V1	V2	Cuantia	m/mr	Col/Vig Eje ppal	Col/vig Eje sec
N+2.86					-47.36	339.42				16/#6 (1.8%)	1.19		1.22
	1.91	.45	.50	.50			-256.27	99.23	112.13				
					106.78	534.01				16/#6 (1.8%)	1.54		
N+0.5					-10.08	-258.01				16/#6 (1.8%)	0.77		2.50
	.10	.45	.50	.50			-292.50	137.85	122.98				
		1.50			-59.14	-307.99				16/#6 (1.8%)	0.88		

Columna B'1-5

Nivel	H Libre	Losa	B	H	M1	M2	P	V1	V2	Cuantia	m/mr	Col/Vig Eje ppal	Col/vig Eje sec
N+1.68					88.63	95.39				12/#8 (2.4%)	0.55		1.22
	1.28	.45	.50	.50			-421.79	111.38	278.40				
		1.50			-80.02	-408.67				12/#8 (2.4%)	0.99		

Columna B'1-7'

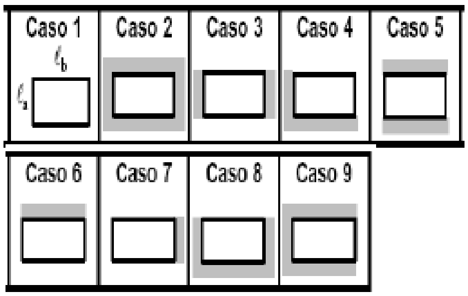
Nivel	H Libre	Losa	B	H	M1	M2	P	V1	V2	Cuantia	m/mr	Col/Vig Eje ppal	Col/vig Eje sec
N+3.5					17.54	286.33				12/#6 (1.4%)	1.50	2.94	1.27
	3.10	.45	.50	.50			-210.36	24.62	126.18				
		.40			0.67	0.96				12/#6 (1.4%)	1.63		5.11

7.5 DISEÑO DE ELEMENTOS COMPLEMENTARIOS

7.5.1 DISEÑO DE PLACA MACIZA

PROYECTO: I.E. MAIA INMACULADA (RAMPA PEATONAL)
DISEÑO PLACA MACIZA (EN UNA DIRECCION)

El diseño de la placa maciza se realiza de acuerdo con lo establecido en C.13.9 de las NSR - 10



Geometría de la losa

la =	1,80	m	fy =	**420**	MPa
lb =	1,90	m	f'c =	**21**	MPa
Relación m =	**0,947**				

h = l/20 (0.4+Fy/700) = 0,09 m

Espesor escogido: 0,10 **m**

Teniendo en cuenta que la relación m es menor de 0.5, la placa maciza trabaja en una dirección

<u>Cargas</u>

Peso propio de la losa	0.1x1.0x24	2,40	kN/m²
Impermeabilización	0.05x20	1,00	kN/m²
Carga Muerta Total		3,40	kN/m²
Carga Viva		5,00	kN/m²
Carga Última		12,08	kN/m²

DISEÑO A MOMENTO FLECTOR

Mu_a =	**4,89**	kN.m	*Cuantía:*	0,0024	*As =*	2,45 cm²/m	***Transversal***
			Cuantía:	0,0018	*As =*	1,80 cm²/m	***Longitudinal***

Distribución de refuerzo:

Colocar 1#4 c/.20 en ambos sentidos

REVISIÓN A CORTANTE

R= 10,87 **kN**

ϕvc =	**0,573**	**MPa**	
ϕvu =	**0,155**	**MPa**	**OK**

8 ESPECIFICACIONES TÉCNICAS

Los materiales utilizados son:

Concreto 21.1 MPa para vigas, placas, zapatas y

columnas. Concreto 14 MPa (para concreto de limpieza).

Acero para refuerzo fy = 420 MPa para todos los diámetros.

Acero estructural A36 pernos de anclaje y platinas

Acero estructural A500 en perfiles metálicos

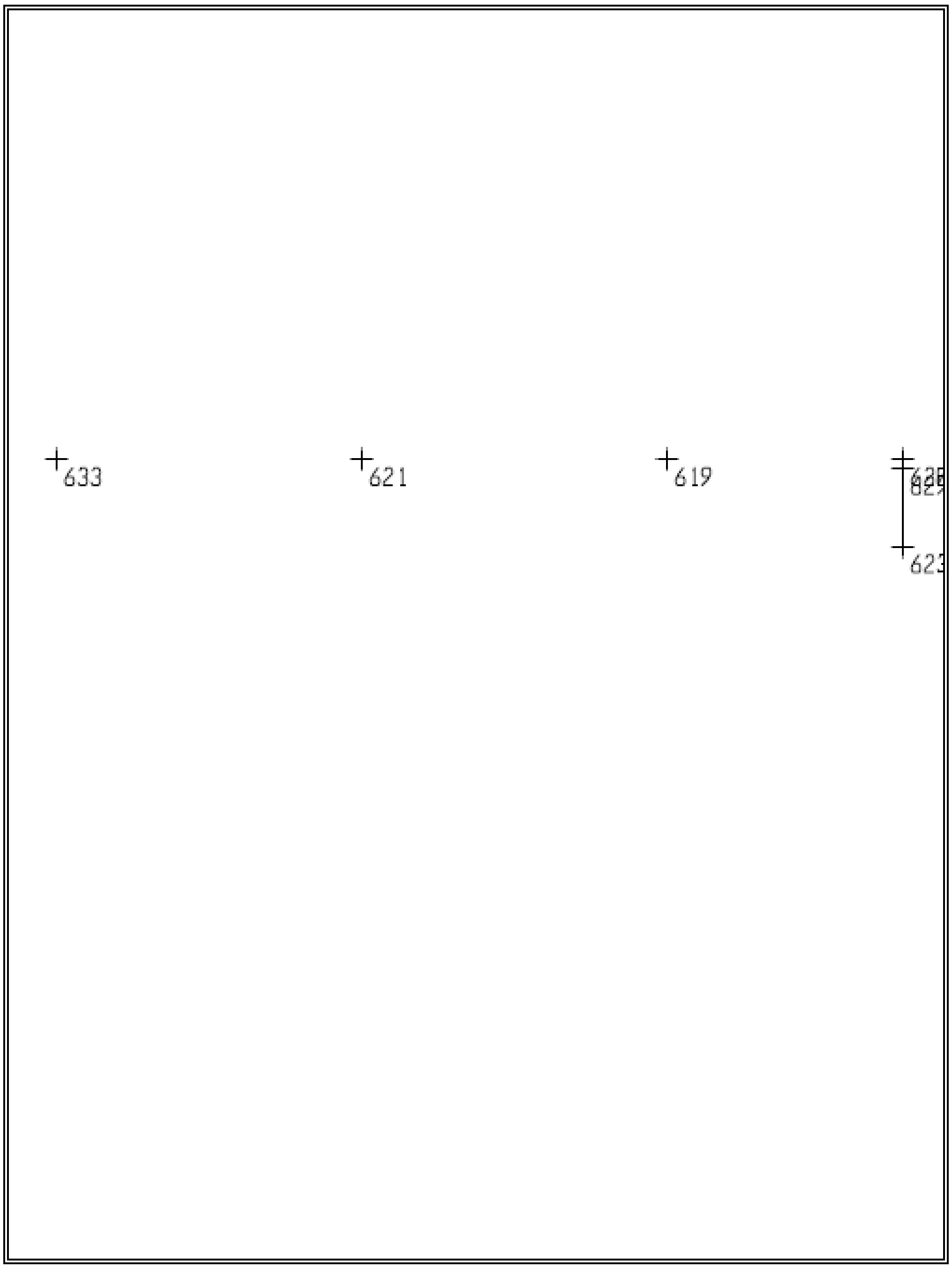
9 CONCLUSIONES Y RECOMENDACIONES

Habiendo finalizado el diseño y análisis estructural de la institución educativa Alfredo Bonilla sede No 2 Maria Inmaculada Grupo 002 basado en la Norma Colombiana de Diseño y Construcción Sismo Resistente Ley 400 de 1997 (Modificada Ley 1229 de 2008) y Decreto 926 de Marzo de 2010, Decreto 092 del 17 de Enero de 2011, Decreto 0340 del 13 de Febrero de 2012 y en el Reglamento para Concreto Estructural ACI 318S-08, hemos llegado a las siguientes conclusiones y recomendaciones.

- Se cumplió satisfactoriamente con los objetivos del cálculo y diseño estructural mediante la aplicación de la norma sismo resistente (NSR-10) y el reglamento para concreto estructural ACI 318S-08, además de la ayuda del software ETABS V9.7.4 se puede garantizar el buen funcionamiento de la estructura que presenta una buena respuesta ante un evento sísmico.
- La revisión de los desplazamientos laterales (derivas) de la estructura teniendo en cuenta las direcciones "X" y "y", nos arrojó que los resultados obtenidos son aceptables permitiendo un buen funcionamiento ante la actuación de un sismo y que cumple con lo establecido en la norma sismo resistente (NSR-10).
- En cuanto a la revisión de columnas y vigas determinamos que cumplen con los requisitos, ya que en estructuras de edificios aporticados es obligatorio que los miembros horizontales fallen antes que los verticales, permitiendo de esa manera un retraso del colapso total de la estructura.
- Para la construcción de la estructura se recomienda llevar un estricto control en la calidad de los materiales a utilizar, ya que estos deberán cumplir con requisitos especiales para el buen funcionamiento de la edificación. Además que estos deberán ser supervisados a la hora de la puesta en marcha por el ingeniero residente.

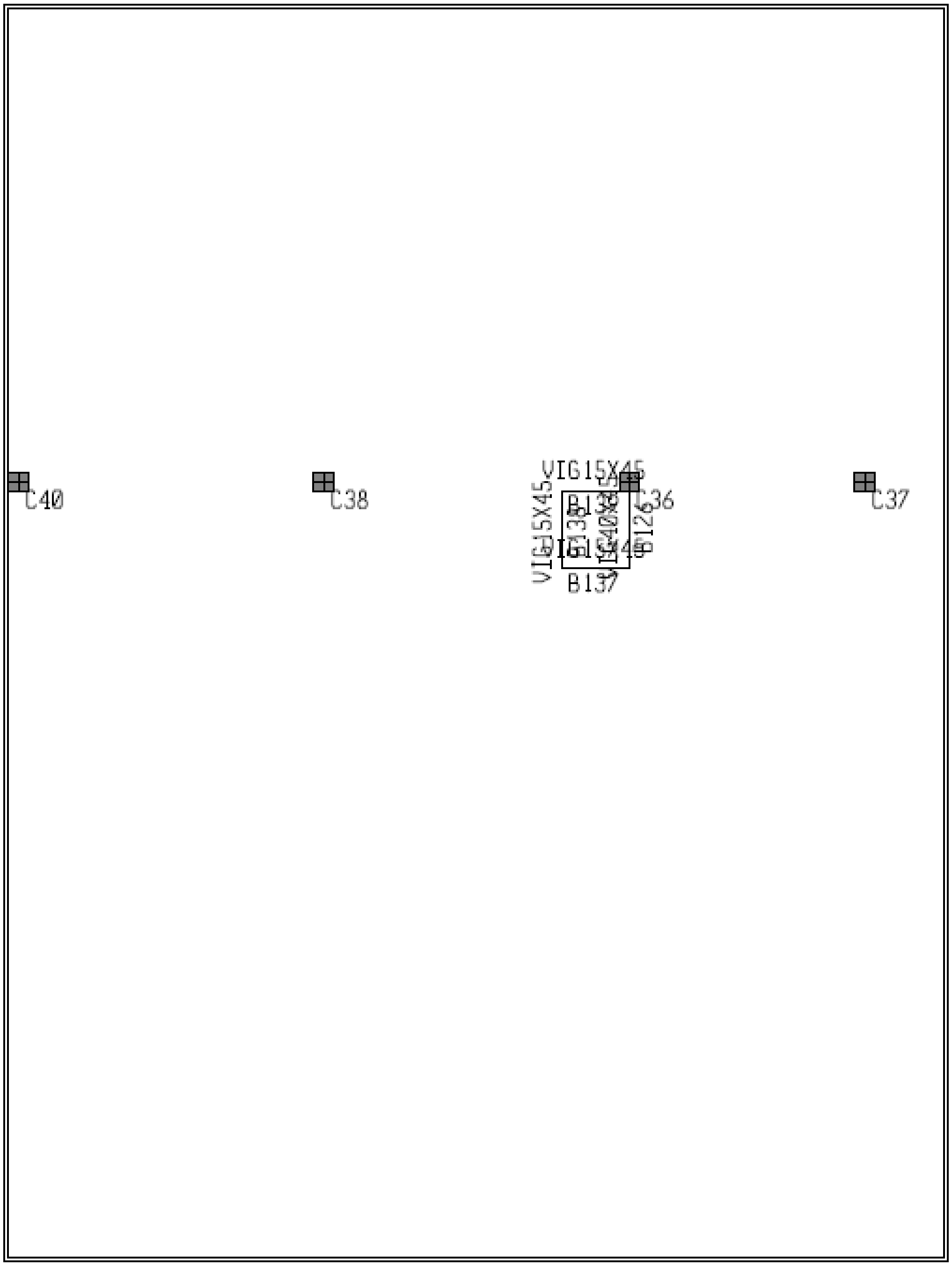
9 ANEXOS

ETABS



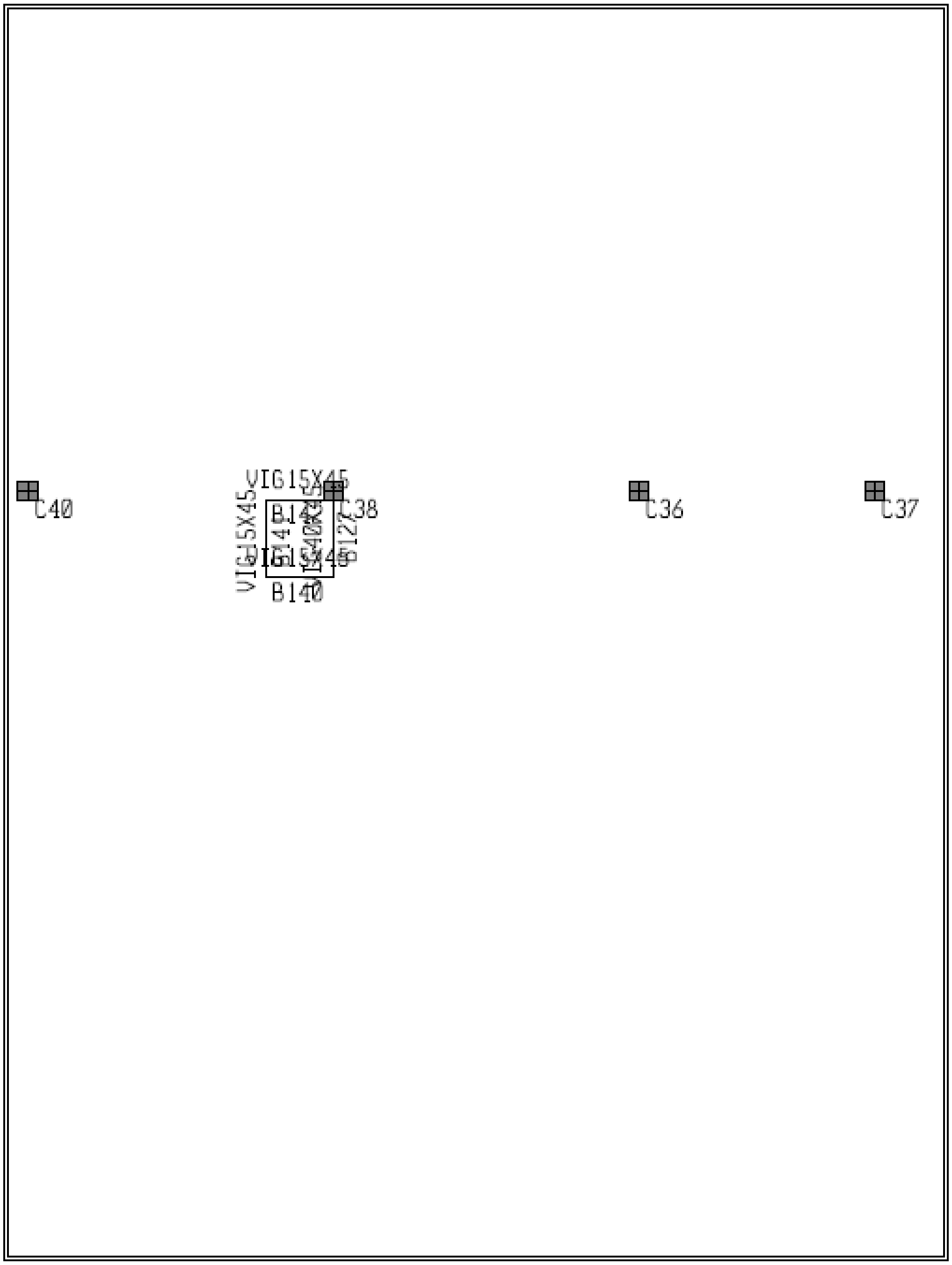
ETABS v9.7.4 - File: RAMPA MARIA INMACULADA - Junio 14,2017 10:47
Plan View - BASE - Elevation -0.05 - KN-m Units

ETABS



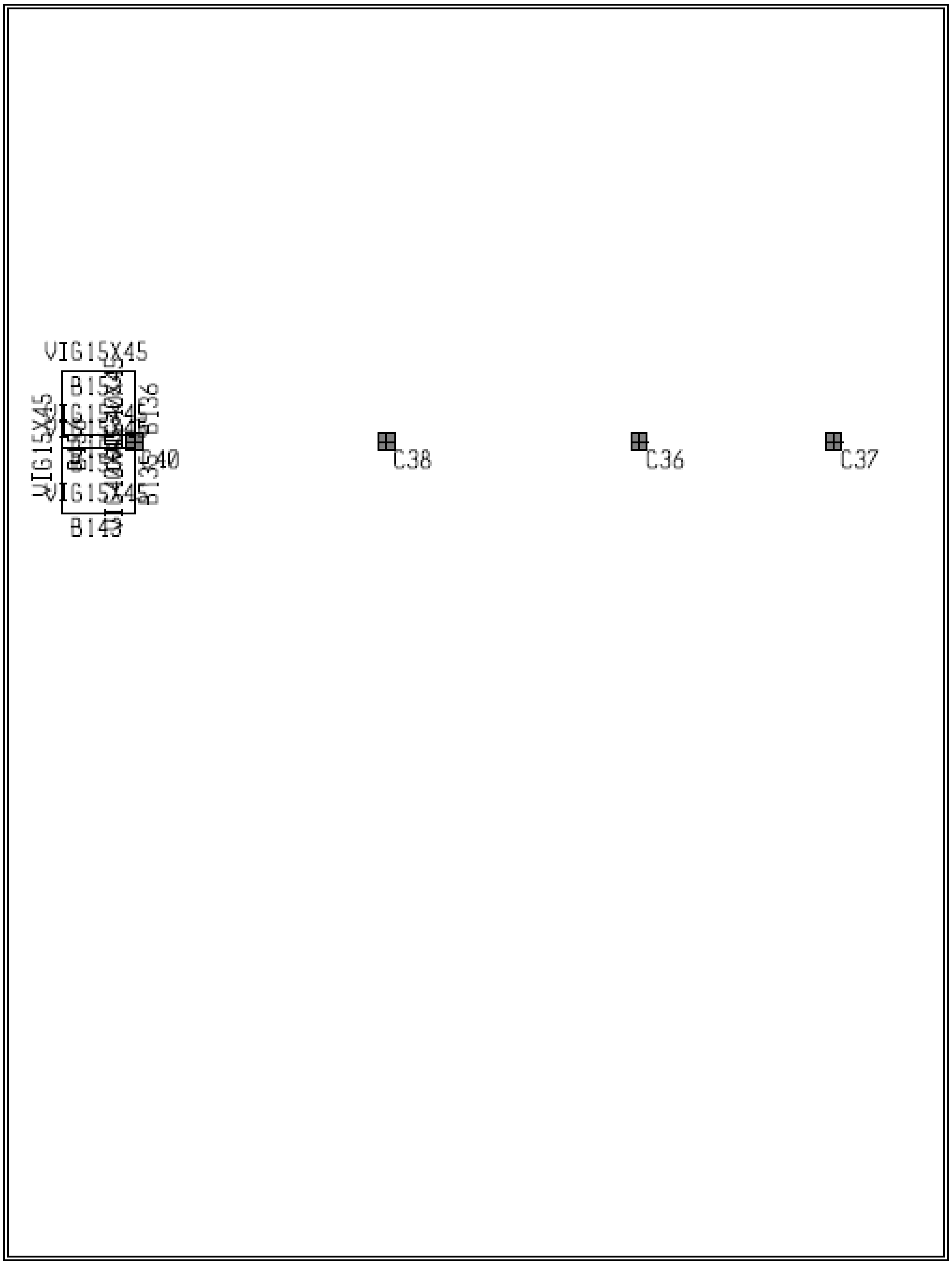
ETABS v9.7.4 - File: RAMPA MARIA INMACULADA - Junio 14,2017 10:49
Plan View - N+0.5 - Elevation 0.5 - KN-m Units

ETABS



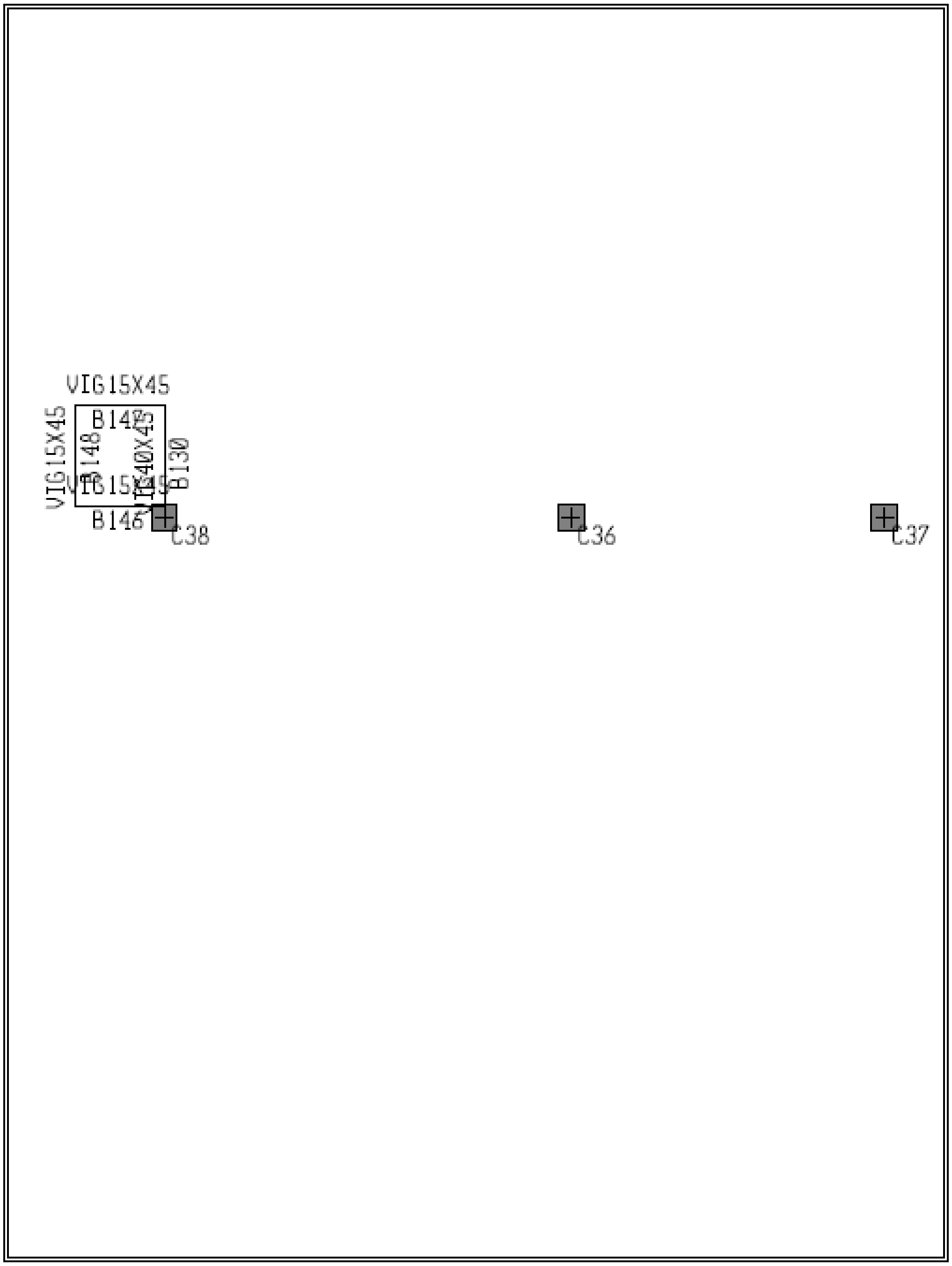
ETABS v9.7.4 - File: RAMPA MARIA INMACULADA - Junio 14,2017 10:49
Plan View - N+1.08 - Elevation 1.08 - KN-m Units

ETABS



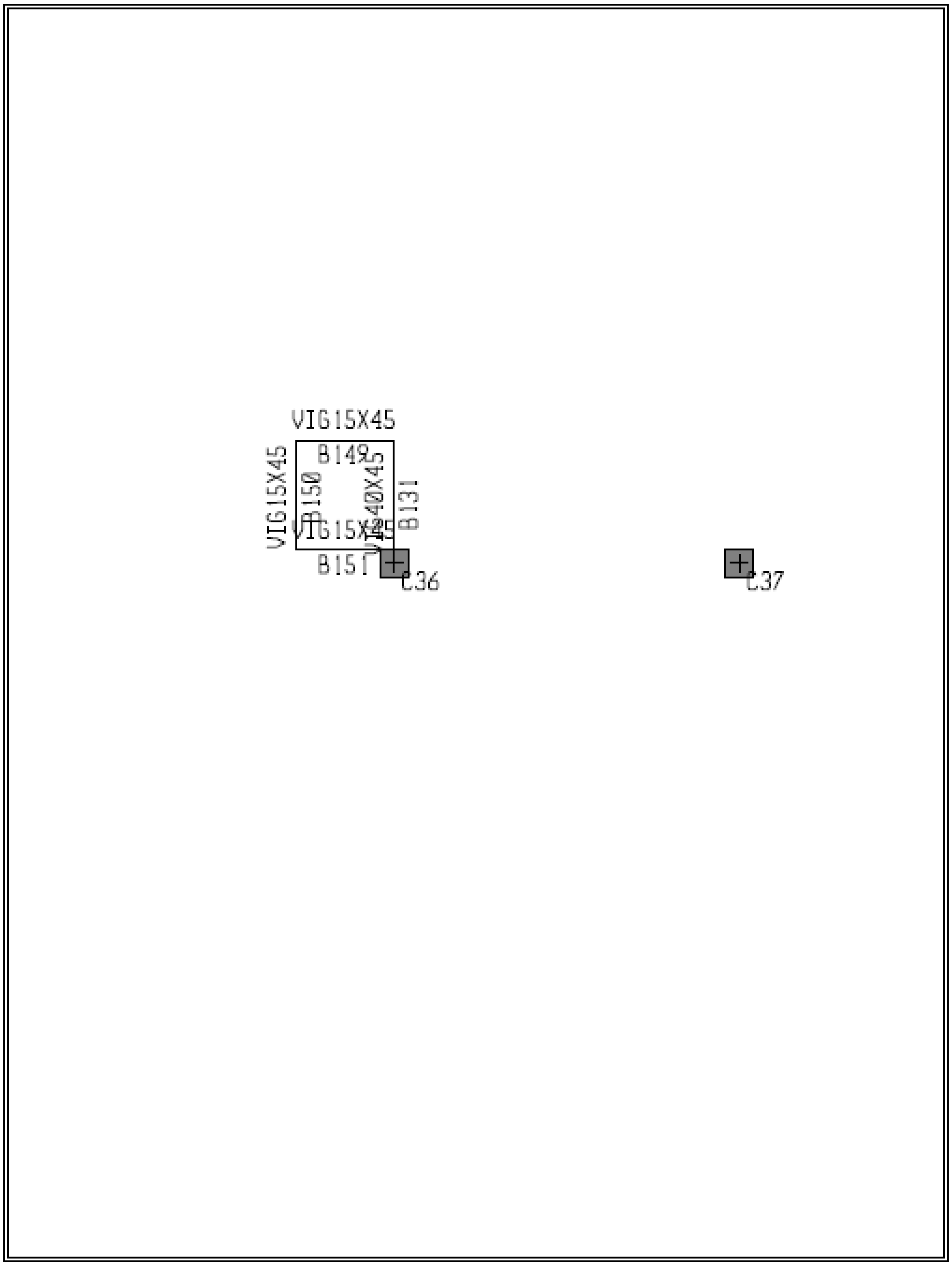
ETABS v9.7.4 - File: RAMPA MARIA INMACULADA - Junio 14,2017 10:51
Plan View - N+1.68 - Elevation 1.68 - KN-m Units

ETABS



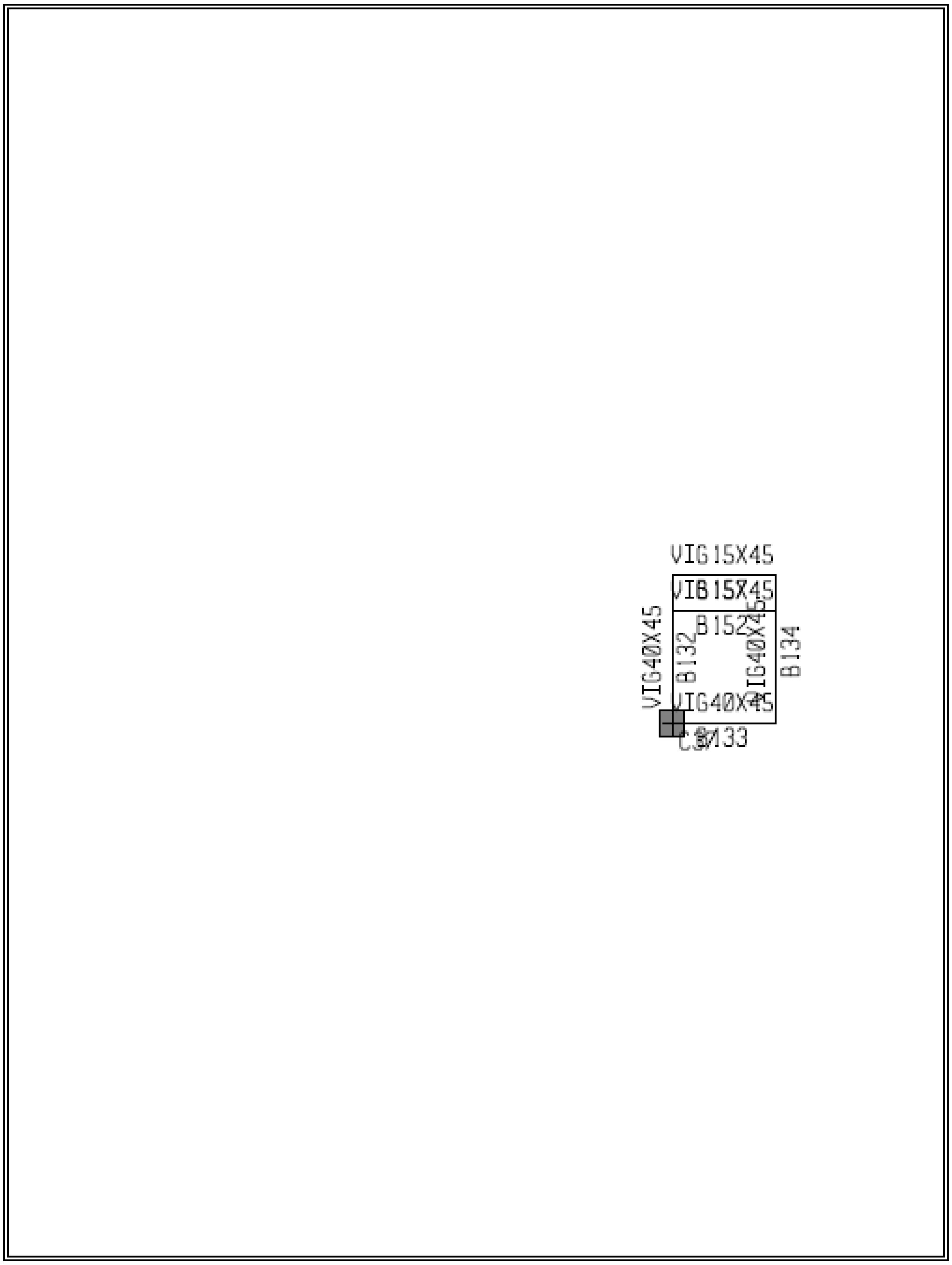
ETABS v9.7.4 - File: RAMPA MARIA INMACULADA - Junio 14,2017 10:54
Plan View - N+2.26 - Elevation 2.26 - KN-m Units

ETABS



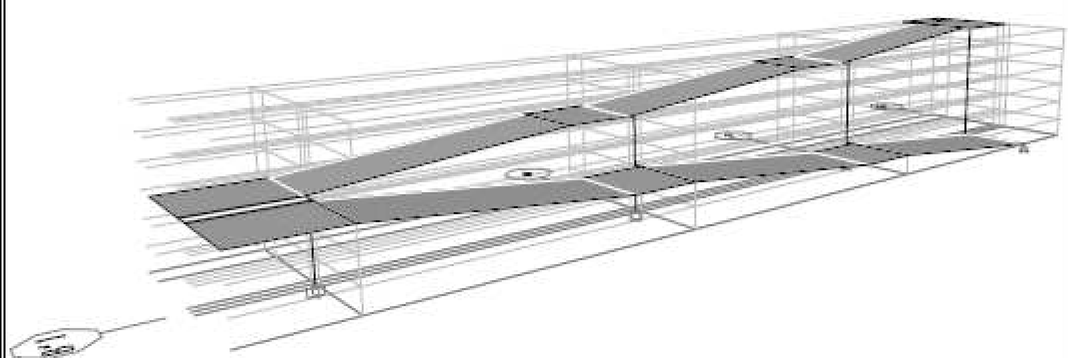
ETABS v9.7.4 - File: RAMPA MARIA INMACULADA - Junio 14,2017 10:55
Plan View - N+2.86 - Elevation 2.86 - KN-m Units

ETABS



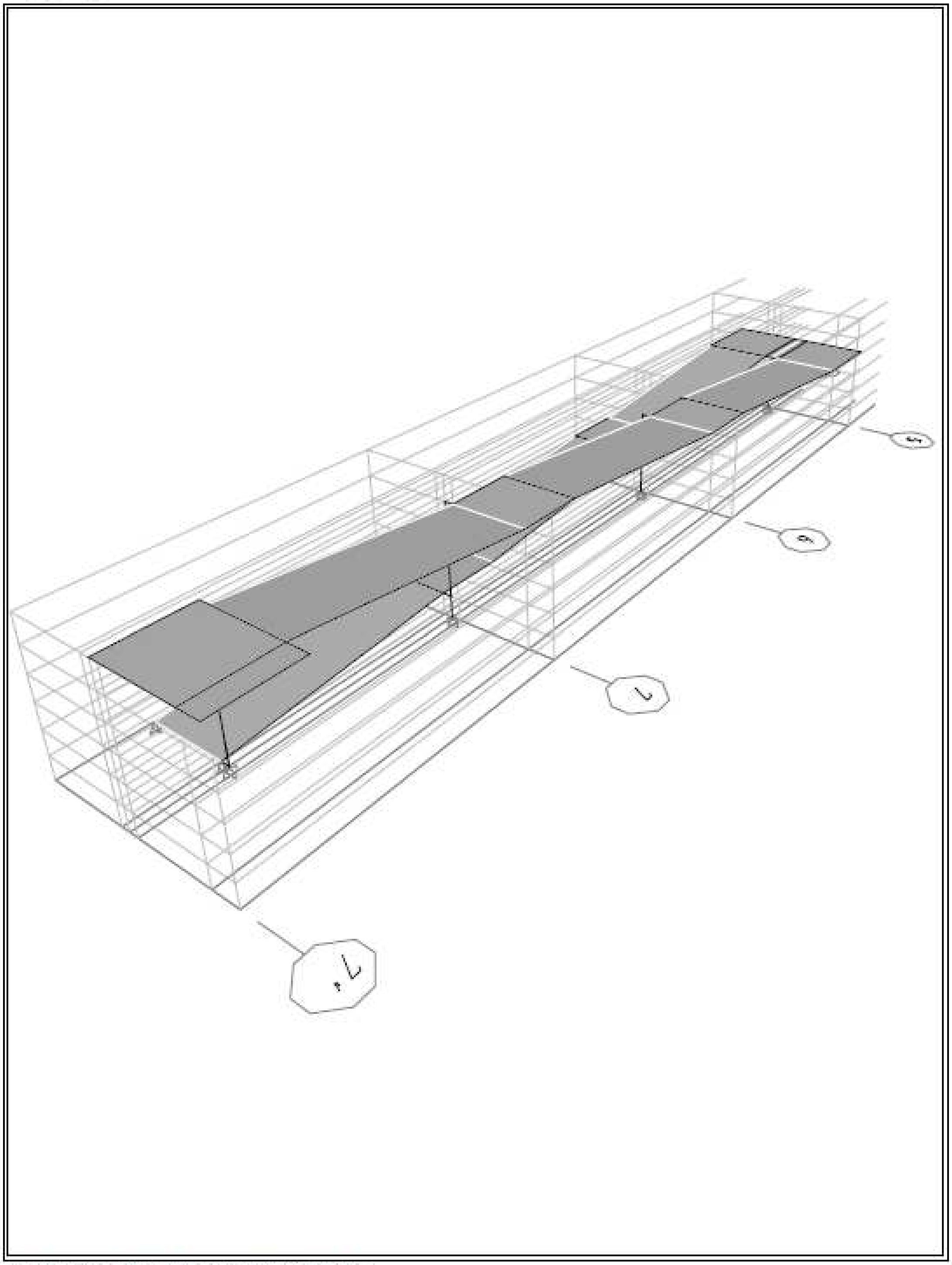
ETABS v9.7.4 - File: RAMPA MARIA INMACULADA - Junio 14,2017 10:55
Plan View - N+3.5 - Elevation 3.5 - KN-m Units

ETABS



ETABS v9.7.4 - File: RAMPA - diciembre 13,2016 16:51
3-D View - KN-m Units

ETABS



ETABS v9.7.4 - File: RAMPA - diciembre 13,2016 16:52
3-D View - KN-m Units

9.1 DATOS DE ENTRADA

ETABS v9.7.4 File:RAMPA Units:KN-m junio 8, 2017 15:38 PAGE 1

S T O R Y D A T A

STORY	SIMILAR TO	HEIGHT	ELEVATION
N+3.5	None	0.640	3.500
N+2.86	None	0.600	2.860
N+2.26	None	0.580	2.260
N+1.68	None	0.600	1.680
N+1.08	None	0.580	1.080
N+0.5	None	0.550	0.500
BASE	None		-0.050

ETABS v9.7.4 File:RAMPA Units:KN-m junio 8, 2017 15:38 PAGE 2

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

POINT	X	Y	DZ-BELOW
618	18.050	0.000	0.000
619	18.050	2.250	0.000
620	24.150	2.250	0.000
621	10.150	2.250	0.000
619-1	18.050	2.250	0.500
620-1	24.150	2.250	0.500
621-1	10.150	2.250	0.500
623	24.150	0.000	0.000
624	10.150	0.000	0.000
627	10.150	4.430	0.000
628	18.050	4.430	0.000
629	24.150	2.025	0.000
630	24.150	5.120	0.000
631	26.180	2.250	0.000
632	26.180	5.120	0.000
633	2.250	2.250	0.000
634	2.250	0.000	0.000
635	2.250	4.430	0.000
633-1	2.250	2.250	0.500
637	18.050	2.025	0.000
638	16.330	0.000	0.000
639	16.330	2.025	0.000
640	8.430	0.000	0.000
641	8.430	2.025	0.000
642	10.150	2.025	0.000
643	0.000	0.000	0.000
645	8.430	2.480	0.000
646	10.150	2.480	0.000
647	8.430	4.430	0.000
648	16.330	4.430	0.000
649	16.330	2.480	0.000
650	18.050	2.480	0.000
651	24.150	4.430	0.000
652	26.180	4.430	0.000
653	0.000	4.430	0.000
654	2.250	2.480	0.000
655	0.000	2.480	0.000
656	0.000	2.025	0.000
657	2.250	2.025	0.000

ETABS v9.7.4 File:RAMPA Units:KN-m junio 8, 2017 15:38 PAGE 3

C O L U M N C O N N E C T I V I T Y D A T A

COLUMN	I END PT	J END PT	I END STORY
C36	619	619	Below
C37	620	620	Below
C38	621	621	Below
C40	633	633	Below

ETABS v9.7.4 File:RAMPA Units:KN-m junio 8, 2017 15:38 PAGE 4

B E A M C O N N E C T I V I T Y D A T A

BEAM	I END PT	J END PT

B125	620	623
B126	618	619
B127	624	621
B130	621	627
B131	619	628
B132	629	630
B133	620	631
B134	631	632
B135	634	633
B136	633	635
B137	638	618
B138	638	639
B139	639	637
B140	640	624
B141	640	641
B142	641	642
B143	643	634
B146	645	646
B147	647	627
B148	647	645
B149	648	628
B150	648	649
B151	649	650
B152	651	652
B153	653	635
B154	655	654
B155	656	657
B156	643	653
B157	630	632

ETABS v9.7.4 File:RAMPA Units:KN-m junio 8, 2017 15:38 PAGE 5

B R A C E   C O N N E C T I V I T Y   D A T A

BRACE	I END PT	J END PT	I END STORY
D24	623	618	Below
D33	629	637	Below
D34	638	624	Below
D35	640	634	Below
D36	635	647	Below
D37	627	648	Below
D38	628	651	Below
D39	639	642	Below
D40	646	649	Below
D41	650	620	Below
D42	654	645	Below
D43	641	657	Below

ETABS v9.7.4 File:RAMPA Units:KN-m junio 8, 2017 15:38 PAGE 6

R I G I D   D I A P H R A G M   P O I N T   C O N N E C T I V I T Y   D A T A

STORY	DIAPHRAGM	POINT	POINT	POINT	POINT	POINT
N+3.5	D6	620	629	630	631	632
		651	652			
N+2.26	D4	621	627	645	646	647
N+1.68	D3	634	633	635	643	653
		654	655	656	657	
N+1.08	D2	621	624	640	641	642
N+0.5	D1	619	618	637	638	639

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M A S S   S O U R C E   D A T A

MASS FROM	LATERAL MASS ONLY	LUMP MASS AT STORIES
Masses	Yes	Yes

ETABS v9.7.4 File:RAMPA Units:KN-m junio 8, 2017 15:38 PAGE 8

D I A P H R A G M   M A S S   D A T A

STORY	DIAPHRAGM	MASS-X	MASS-Y	MMI	X-M	Y-M
N+3.5	D6	7.856E+00	7.856E+00	2.114E+01	24.999	3.518
N+2.26	D4	5.473E+00	5.473E+00	9.470E+00	9.416	3.397
N+1.68	D3	1.066E+01	1.066E+01	3.871E+01	1.483	2.222
N+1.08	D2	5.752E+00	5.752E+00	1.040E+01	9.439	1.108
N+0.5	D1	5.724E+00	5.724E+00	1.035E+01	17.336	1.105

ETABS v9.7.4 File:RAMPA Units:KN-m junio 8, 2017 15:38 PAGE 9

A S S E M B L E D   P O I N T   M A S S E S

STORY	POINT	UX	UY	UZ	RX	RY	RZ
N+3.5	723	7.856E+00	7.856E+00	0.000E+00	0.000E+00	0.000E+00	2.114E+01
N+2.86	619	6.509E-01	6.509E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00
N+2.86	620	3.720E-01	3.720E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00
N+2.86	628	1.475E+00	1.475E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
N+2.86	648	1.168E+00	1.168E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
N+2.86	649	1.168E+00	1.168E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
N+2.86	650	1.005E+00	1.005E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
N+2.26	619	3.540E-01	3.540E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00
N+2.26	620	3.540E-01	3.540E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00
N+2.26	724	5.473E+00	5.473E+00	0.000E+00	0.000E+00	0.000E+00	9.470E+00
N+1.68	619	3.540E-01	3.540E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00
N+1.68	620	3.540E-01	3.540E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00
N+1.68	621	3.540E-01	3.540E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00
N+1.68	725	1.066E+01	1.066E+01	0.000E+00	0.000E+00	0.000E+00	3.871E+01
N+1.08	619	3.540E-01	3.540E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00
N+1.08	620	3.540E-01	3.540E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00
N+1.08	633	3.540E-01	3.540E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00
N+1.08	726	5.752E+00	5.752E+00	0.000E+00	0.000E+00	0.000E+00	1.040E+01
N+0.5	620	3.390E-01	3.390E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00
N+0.5	621	3.390E-01	3.390E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00
N+0.5	633	3.390E-01	3.390E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00
N+0.5	727	5.724E+00	5.724E+00	0.000E+00	0.000E+00	0.000E+00	1.035E+01
BASE	619	1.650E-01	1.650E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00
BASE	620	5.970E-01	5.970E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00
BASE	621	1.650E-01	1.650E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00
BASE	623	9.281E-01	9.281E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00
BASE	629	4.961E-01	4.961E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00
BASE	633	1.650E-01	1.650E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00
N+3.5	All	7.856E+00	7.856E+00	0.000E+00	0.000E+00	0.000E+00	2.114E+01
N+2.86	All	5.840E+00	5.840E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
N+2.26	All	6.181E+00	6.181E+00	0.000E+00	0.000E+00	0.000E+00	9.470E+00
N+1.68	All	1.172E+01	1.172E+01	0.000E+00	0.000E+00	0.000E+00	3.871E+01
N+1.08	All	6.814E+00	6.814E+00	0.000E+00	0.000E+00	0.000E+00	1.040E+01
N+0.5	All	6.741E+00	6.741E+00	0.000E+00	0.000E+00	0.000E+00	1.035E+01
BASE	All	2.516E+00	2.516E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Totals	All	4.767E+01	4.767E+01	0.000E+00	0.000E+00	0.000E+00	9.006E+01

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M A T E R I A L   L I S T   B Y   E L E M E N T   T Y P E

ELEMENT TYPE	MATERIAL	TOTAL MASS tons	NUMBER PIECES	NUMBER STUDS
Column	CONC21	6.42	18	
Beam	CONC21	16.73	29	0
Brace	CONC21	12.26	12	
Floor	CONC21	13.20		

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M A T E R I A L   L I S T   B Y   S E C T I O N

SECTION	ELEMENT TYPE	NUMBER PIECES	TOTAL LENGTH meters	TOTAL MASS tons	NUMBER STUDS
VIG40X45	Beam	9	21.285	9.38	0
VIG15X45	Beam	19	39.200	6.48	0
VIG15X45	Brace	12	74.186	12.26	

COL50X50	Column		18	10.500	6.42			
VIG40X40	Beam		1	2.250	0.88	0		
PLACAMAC	Floor				13.20			

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M A T E R I A L   L I S T   B Y   S T O R Y

STORY	ELEMENT TYPE	MATERIAL	TOTAL WEIGHT tons	FLOOR AREA m2	UNIT WEIGHT kg/m2	NUMBER PIECES	NUMBER STUDS
N+3.5	Column	CONC21	0.39	5.826	67.2098	1	
N+3.5	Beam	CONC21	4.19	5.826	719.6279	5	0
N+3.5	Brace	CONC21	2.03	5.826	347.9414	2	
N+3.5	Floor	CONC21	2.61	5.826	447.8594		
N+2.86	Column	CONC21	0.73	3.354	218.9015	2	
N+2.86	Beam	CONC21	1.85	3.354	551.7960	4	0
N+2.86	Brace	CONC21	2.05	3.354	611.6275	2	
N+2.86	Floor	CONC21	1.50	3.354	447.8594		
N+2.26	Column	CONC21	1.06	3.354	317.4072	3	
N+2.26	Beam	CONC21	1.85	3.354	551.7960	4	0
N+2.26	Brace	CONC21	2.05	3.354	611.4402	2	
N+2.26	Floor	CONC21	1.50	3.354	447.8594		
N+1.68	Column	CONC21	1.47	9.968	147.3179	4	
N+1.68	Beam	CONC21	4.17	9.968	418.3645	7	0
N+1.68	Brace	CONC21	2.05	9.968	205.8087	2	
N+1.68	Floor	CONC21	4.46	9.968	447.8594		
N+1.08	Column	CONC21	1.42	3.483	407.5352	4	
N+1.08	Beam	CONC21	1.89	3.483	543.7696	4	0
N+1.08	Brace	CONC21	2.05	3.483	588.7943	2	
N+1.08	Floor	CONC21	1.56	3.483	447.8594		
N+0.5	Column	CONC21	1.35	3.483	386.4557	4	
N+0.5	Beam	CONC21	1.89	3.483	543.7696	4	0
N+0.5	Brace	CONC21	2.02	3.483	580.9769	2	
N+0.5	Floor	CONC21	1.56	3.483	447.8594		
BASE	Beam	CONC21	0.88	0.000	1	0	
SUM	Column	CONC21	6.42	29.468	218.0093	18	
SUM	Beam	CONC21	16.73	29.468	567.8458	29	0
SUM	Brace	CONC21	12.26	29.468	415.8812	12	
SUM	Floor	CONC21	13.20	29.468	447.8594		
TOTAL	All	All	48.61	29.468	1649.5957	59	0

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M A T E R I A L   P R O P E R T Y   D A T A

MATERIAL NAME	MATERIAL TYPE	DESIGN TYPE	MATERIAL DIR/PLANE	MODULUS OF ELASTICITY	POISSON'S RATIO	THERMAL COEFF	SHEAR MODULUS
STEEL	Iso	Steel	All	199947978.80	0.3000	1.1700E-05	76903068.77
CONC21	Iso	Concrete	All	21538000.000	0.2000	9.9000E-06	8974166.667
OTHER	Iso	None	All	199947978.80	0.3000	1.1700E-05	76903068.77
RAMPA	Iso	Concrete	All	0.000	0.2000	9.9000E-06	0.000

M A T E R I A L   P R O P E R T Y   M A S S   A N D   W E I G H T

MATERIAL NAME	MASS PER UNIT VOL	WEIGHT PER UNIT VOL
STEEL	7.8271E+00	7.6820E+01
CONC21	2.4000E+00	2.4000E+01
OTHER	7.8271E+00	7.6820E+01
RAMPA	2.4000E+00	0.0000E+00

M A T E R I A L   D E S I G N   D A T A   F O R   S T E E L   M A T E R I A L S

MATERIAL STEEL STEEL STEEL

NAME	FY	FU	COST ($)
STEEL	344737.894	448159.263	271447.16

MATERIAL DESIGN DATA FOR CONCRETE MATERIALS

MATERIAL NAME	LIGHTWEIGHT CONCRETE	CONCRETE FC	REBAR FY	REBAR FYS	LIGHTWT REDUC FACT
CONC21	No	21000.000	420000.000	420000.000	N/A
RAMPA	No	21000.000	420000.000	420000.000	N/A

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FRAME SECTION PROPERTY DATA

FRAME SECTION NAME	MATERIAL NAME	SECTION SHAPE NAME OR NAME IN SECTION DATABASE FILE	CONC COL	CONC BEAM
VIG40X45	CONC21	Rectangular		Yes
VIG15X45	CONC21	Rectangular		Yes
COL50X50	CONC21	Rectangular	Yes	
VIG40X40	CONC21	Rectangular		Yes

FRAME SECTION PROPERTY DATA

FRAME SECTION NAME	SECTION DEPTH	FLANGE WIDTH TOP	FLANGE THICK TOP	WEB THICK	FLANGE WIDTH BOT	FLANGE THICK BOT
VIG40X45	0.4500	0.4000	0.0000	0.0000	0.0000	0.0000
VIG15X45	0.4500	0.1500	0.0000	0.0000	0.0000	0.0000
COL50X50	0.5000	0.5000	0.0000	0.0000	0.0000	0.0000
VIG40X40	0.4000	0.4000	0.0000	0.0000	0.0000	0.0000

FRAME SECTION PROPERTY DATA

FRAME SECTION NAME	SECTION AREA	TORSIONAL CONSTANT	MOMENTS OF INERTIA I33	I22	SHEAR AREAS A2	A3
VIG40X45	0.1800	0.0045	0.0030	0.0024	0.1500	0.1500
VIG15X45	0.0675	0.0004	0.0011	0.0001	0.0563	0.0563
COL50X50	0.2500	0.0088	0.0052	0.0052	0.2083	0.2083
VIG40X40	0.1600	0.0036	0.0021	0.0021	0.1333	0.1333

FRAME SECTION PROPERTY DATA

FRAME SECTION NAME	SECTION MODULI S33	S22	PLASTIC MODULI Z33	Z22	RADIUS OF GYRATION R33	R22
VIG40X45	0.0135	0.0120	0.0203	0.0180	0.1299	0.1155
VIG15X45	0.0051	0.0017	0.0076	0.0025	0.1299	0.0433
COL50X50	0.0208	0.0208	0.0313	0.0313	0.1443	0.1443
VIG40X40	0.0107	0.0107	0.0160	0.0160	0.1155	0.1155

FRAME SECTION WEIGHTS AND MASSES

FRAME SECTION NAME	TOTAL WEIGHT	TOTAL MASS
VIG40X45	91.9512	9.1951
VIG15X45	183.6847	18.3685
COL50X50	63.0000	6.3000
VIG40X40	8.6400	0.8640

CONCRETE COLUMN DATA

FRAME SECTION NAME	REINF CONFIGURATION LONGIT	LATERAL	REINF SIZE/TYPE	NUM BARS 3DIR/2DIR	NUM BARS CIRCULAR	BAR COVER
COL50X50	Rectangular	Ties	#9/Design	3/3	N/A	0.0457

C O N C R E T E   B E A M   D A T A

FRAME SECTION NAME	TOP COVER	BOT COVER	TOP LEFT AREA	TOP RIGHT AREA	BOT LEFT AREA	BOT RIGHT AREA
VIG40X45	0.0500	0.0500	0.000	0.000	0.000	0.000
VIG15X45	0.0500	0.0500	0.000	0.000	0.000	0.000
VIG40X40	0.0457	0.0457	0.000	0.000	0.000	0.000

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

SHELL SECTION	MATERIAL NAME	SHELL TYPE	LOAD DIST ONE WAY	MEMBRANE THICK	BENDING THICK	TOTAL WEIGHT	TOTAL MASS
CUBLIV	CONC21	Membrane	Yes	0.0130	0.0130	0.0000	0.0000
PLACAMAC	CONC21	Membrane	No	0.1830	0.1830	129.4217	12.9422
RAMPA	CONC21	Membrane	Yes	0.1830	0.1830	0.0000	0.0000

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

STATIC CASE	CASE TYPE	AUTO LAT LOAD	SELF WT MULTIPLIER	NOTIONAL FACTOR	NOTIONAL DIRECTION
DEAD	DEAD	N/A	1.0000		
LIVE	LIVE	N/A	0.0000		

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R E S P O N S E   S P E C T R U M   C A S E S

RESP SPEC CASE: SISDERX

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0500	0.0000	0.0500

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	DERIVAS	16.0620
U2	----	N/A
UZ	----	N/A

RESP SPEC CASE: SISDERY

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0500	0.0000	0.0500

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	----	N/A
U2	DERIVAS	17.2980
UZ	----	N/A

RESP SPEC CASE: SISDISX

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0500	0.0000	0.0500

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	DISENO	16.0620
U2	----	N/A
UZ	----	N/A

RESP SPEC CASE: SISDISY

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0500	0.0000	0.0500

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	----	N/A
U2	DISENO	17.2980
UZ	----	N/A

RESP SPEC CASE: SISUMBX

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0200	0.0000	0.0200

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	UMBRAL	34.2270
U2	----	N/A
UZ	----	N/A

RESP SPEC CASE: SISUMBY

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0200	0.0000	0.0200

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	----	N/A
U2	UMBRAL	28.5430
UZ	----	N/A

L O A D I N G   C O M B I N A T I O N S

COMBO	COMBO TYPE	CASE	CASE TYPE	SCALE FACTOR

CIMEN	ADD	DEAD	Static	1.0000
		LIVE	Static	1.0000
COMDIS1	ADD	DEAD	Static	1.4000
COMDIS2	ADD	DEAD	Static	1.2000
		LIVE	Static	1.6000
COMDIS3	ADD	DEAD	Static	1.2000
		LIVE	Static	1.0000
		SISDISX	Spectra	1.0000
		SISDISY	Spectra	0.3000
COMDIS4	ADD	DEAD	Static	1.2000
		LIVE	Static	1.0000
		SISDISX	Spectra	0.3000
		SISDISY	Spectra	1.0000
COMDIS5	ADD	DEAD	Static	0.9000
		SISDISX	Spectra	1.0000
		SISDISY	Spectra	0.3000
COMDIS6	ADD	DEAD	Static	0.9000
		SISDISX	Spectra	0.3000
		SISDISY	Spectra	1.0000
ENVOLVENTE	ENVE	COMDIS1	Combo	1.0000
		COMDIS2	Combo	1.0000
		COMDIS3	Combo	1.0000
		COMDIS4	Combo	1.0000
		COMDIS5	Combo	1.0000
		COMDIS6	Combo	1.0000
CIMEN2	ADD	DEAD	Static	1.0000
		LIVE	Static	0.7500
		SISDISX	Spectra	0.5250
		SISDISY	Spectra	0.1575
CIMEM3	ADD	DEAD	Static	1.0000
		LIVE	Static	0.7500
		SISDISX	Spectra	0.1575
		SISDISY	Spectra	0.5250
COMDER1	ADD	SISDERX	Spectra	1.0000
		SISDERY	Spectra	0.3000
COMDER2	ADD	SISDERX	Spectra	0.3000
		SISDERY	Spectra	1.0000
COMDERUMB1	ADD	SISUMBX	Spectra	1.0000
		SISUMBY	Spectra	0.3000
COMDERUMB2	ADD	SISUMBX	Spectra	0.3000
		SISUMBY	Spectra	1.0000

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R E S P O N S E S P E C T R U M F U N C T I O N - F R O M F I L E

FUNCTION NAME: DERIVAS

FILE NAME: c:\users\dyein_000\desktop\cristian\dye16-2285 maria inmaculada\modelo\rampa\derivas.txt
DATA TYPE: Period vs Acceleration
NUMBER OF HEADER LINES = 0

PERIOD	ACCEL
0.0000	1.1330
0.0500	1.1330
0.1000	1.1330
0.1600	1.1330
0.2100	1.1330
0.4000	1.1330
0.6000	1.1330
0.8000	1.1330
0.9900	1.1330
1.3400	0.8410
1.6800	0.6690
2.0300	0.5550
2.3700	0.4740
2.7200	0.4140
3.0600	0.3670
3.4100	0.3300
3.7500	0.3000
4.1000	0.2750
4.4400	0.2530
4.7900	0.2350
5.1300	0.2190
5.4800	0.2050
5.8200	0.1930

6.1700	0.1820
6.5100	0.1730
6.8600	0.1640
7.2000	0.1560
8.2000	0.1200
9.2000	0.0960

FUNCTION NAME: DISENO

FILE NAME: c:\users\dyein_000\desktop\cristian\dye16-2285 maria inmaculada\modelo\rampa\diseño.txt
DATA TYPE: Period vs Acceleration
NUMBER OF HEADER LINES = 0

PERIOD	ACCEL
0.0000	0.7552
0.0520	0.7552
0.1030	0.7552
0.1550	0.7552
0.2070	0.7552
0.4030	0.7552
0.6000	0.7552
0.7970	0.7552
0.9930	0.7552
1.3380	0.5606
1.6830	0.4457
2.0280	0.3699
2.3720	0.3161
2.7170	0.2760
3.0620	0.2449
3.4070	0.2201
3.7520	0.1999
4.0970	0.1831
4.4410	0.1689
4.7860	0.1567
5.1310	0.1462
5.4760	0.1370
5.8210	0.1289
6.1660	0.1216
6.5100	0.1152
6.8550	0.1094
7.2000	0.1042
8.2000	0.0803
9.2000	0.0638

FUNCTION NAME: UMBRAL

FILE NAME: c:\users\dyein_000\desktop\cristian\dye16-2285 maria inmaculada\modelo\rampa\umbral.txt
DATA TYPE: Period vs Acceleration
NUMBER OF HEADER LINES = 0

PERIOD	ACCEL
0.0000	0.0900
0.0500	0.1260
0.1000	0.1620
0.1500	0.1980
0.2000	0.2340
0.2500	0.2700
0.4900	0.2700
0.7300	0.2700
0.9800	0.2700
1.2200	0.2700
1.4600	0.2700
1.7000	0.2700
1.9500	0.2700
2.1900	0.2700
2.7800	0.2120
3.3800	0.1750
3.9700	0.1490
4.5600	0.1290
5.1600	0.1150
5.7500	0.1030
6.3400	0.0930

6.9400	0.0850
7.5300	0.0780
8.1300	0.0730
8.7200	0.0680
9.3100	0.0630
9.9100	0.0600
10.5000	0.0560
11.5000	0.0470
12.5000	0.0400

F R A M E   S E C T I O N   A S S I G N M E N T S   T O   L I N E   O B J E C T S

STORY LEVEL	LINE ID	LINE TYPE	SECTION TYPE	AUTO SELECT SECTION	ANALYSIS SECTION	DESIGN PROCEDURE	DESIGN SECTION
N+3.5	C37	Column	Rectangular	None	COL50X50	Conc Frame	COL50X50
N+2.86	C36	Column	Rectangular	None	COL50X50	Conc Frame	COL50X50
N+2.86	C37	Column	Rectangular	None	COL50X50	Conc Frame	COL50X50
N+2.26	C36	Column	Rectangular	None	COL50X50	Conc Frame	COL50X50
N+2.26	C37	Column	Rectangular	None	COL50X50	Conc Frame	COL50X50
N+2.26	C38	Column	Rectangular	None	COL50X50	Conc Frame	COL50X50
N+1.68	C36	Column	Rectangular	None	COL50X50	Conc Frame	COL50X50
N+1.68	C37	Column	Rectangular	None	COL50X50	Conc Frame	COL50X50
N+1.68	C38	Column	Rectangular	None	COL50X50	Conc Frame	COL50X50
N+1.68	C40	Column	Rectangular	None	COL50X50	Conc Frame	COL50X50
N+1.08	C36	Column	Rectangular	None	COL50X50	Conc Frame	COL50X50
N+1.08	C37	Column	Rectangular	None	COL50X50	Conc Frame	COL50X50
N+1.08	C38	Column	Rectangular	None	COL50X50	Conc Frame	COL50X50
N+1.08	C40	Column	Rectangular	None	COL50X50	Conc Frame	COL50X50
N+0.5	C36	Column	Rectangular	None	COL50X50	Conc Frame	COL50X50
N+0.5	C37	Column	Rectangular	None	COL50X50	Conc Frame	COL50X50
N+0.5	C38	Column	Rectangular	None	COL50X50	Conc Frame	COL50X50
N+0.5	C40	Column	Rectangular	None	COL50X50	Conc Frame	COL50X50
N+3.5	B132	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.5	B133	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.5	B134	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+3.5	B152	Beam	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+3.5	B157	Beam	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+2.86	B131	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+2.86	B149	Beam	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+2.86	B150	Beam	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+2.86	B151	Beam	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+2.26	B130	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+2.26	B146	Beam	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+2.26	B147	Beam	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+2.26	B148	Beam	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+1.68	B135	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+1.68	B136	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+1.68	B143	Beam	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+1.68	B153	Beam	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+1.68	B154	Beam	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+1.68	B155	Beam	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+1.68	B156	Beam	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+1.08	B127	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+1.08	B140	Beam	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+1.08	B141	Beam	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+1.08	B142	Beam	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+0.5	B126	Beam	Rectangular	None	VIG40X45	Conc Frame	VIG40X45
N+0.5	B137	Beam	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+0.5	B138	Beam	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+0.5	B139	Beam	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
BASE	B125	Beam	Rectangular	None	VIG40X40	Conc Frame	VIG40X40
N+3.5	D38	Brace	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+3.5	D41	Brace	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+2.86	D37	Brace	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+2.86	D40	Brace	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+2.26	D36	Brace	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+2.26	D42	Brace	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+1.68	D35	Brace	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+1.68	D43	Brace	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+1.08	D34	Brace	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+1.08	D39	Brace	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+0.5	D24	Brace	Rectangular	None	VIG15X45	Conc Frame	VIG15X45
N+0.5	D33	Brace	Rectangular	None	VIG15X45	Conc Frame	VIG15X45

L I N E   A U T O M E S H   A S S I G N M E N T S

STORY	LINE	LINETYPE	AUTOMESH
N+3.5	C37	Column	P/L/E
N+2.86	C36	Column	P/L/E
N+2.86	C37	Column	P/L/E
N+2.26	C36	Column	P/L/E
N+2.26	C37	Column	P/L/E
N+2.26	C38	Column	P/L/E
N+1.68	C36	Column	P/L/E
N+1.68	C37	Column	P/L/E
N+1.68	C38	Column	P/L/E
N+1.68	C40	Column	P/L/E
N+1.08	C36	Column	P/L/E
N+1.08	C37	Column	P/L/E
N+1.08	C38	Column	P/L/E
N+1.08	C40	Column	P/L/E
N+0.5	C36	Column	P/L/E
N+0.5	C37	Column	P/L/E
N+0.5	C38	Column	P/L/E
N+0.5	C40	Column	P/L/E
N+3.5	B132	Beam	P/L/E
N+3.5	B133	Beam	P/L/E
N+3.5	B134	Beam	P/L/E
N+3.5	B152	Beam	P/L/E
N+3.5	B157	Beam	P/L/E
N+2.86	B131	Beam	P/L/E
N+2.86	B149	Beam	P/L/E
N+2.86	B150	Beam	P/L/E
N+2.86	B151	Beam	P/L/E
N+2.26	B130	Beam	P/L/E
N+2.26	B146	Beam	P/L/E
N+2.26	B147	Beam	P/L/E
N+2.26	B148	Beam	P/L/E
N+1.68	B135	Beam	P/L/E
N+1.68	B136	Beam	P/L/E
N+1.68	B143	Beam	P/L/E
N+1.68	B153	Beam	P/L/E
N+1.68	B154	Beam	P/L/E
N+1.68	B155	Beam	P/L/E
N+1.68	B156	Beam	P/L/E
N+1.08	B127	Beam	P/L/E
N+1.08	B140	Beam	P/L/E
N+1.08	B141	Beam	P/L/E
N+1.08	B142	Beam	P/L/E
N+0.5	B126	Beam	P/L/E
N+0.5	B137	Beam	P/L/E
N+0.5	B138	Beam	P/L/E
N+0.5	B139	Beam	P/L/E
BASE	B125	Beam	P/L/E
N+3.5	D38	Brace	P/L/E
N+3.5	D41	Brace	P/L/E
N+2.86	D37	Brace	P/L/E
N+2.86	D40	Brace	P/L/E
N+2.26	D36	Brace	P/L/E
N+2.26	D42	Brace	P/L/E
N+1.68	D35	Brace	P/L/E
N+1.68	D43	Brace	P/L/E
N+1.08	D34	Brace	P/L/E
N+1.08	D39	Brace	P/L/E
N+0.5	D24	Brace	P/L/E
N+0.5	D33	Brace	P/L/E

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U N I F O R M   L O A D   A S S I G N M E N T S   T O   A R E A   O B J E C T S

CASE	STORY	AREA	AREATYPE	DIRECTION	LOAD
LIVE	N+3.5	F19	Floor	Gravity	5.0000
LIVE	N+3.5	F20	Floor	Gravity	5.0000
LIVE	N+2.86	F18	Floor	Gravity	5.0000
LIVE	N+2.26	F17	Floor	Gravity	5.0000
LIVE	N+1.68	F12	Floor	Gravity	5.0000
LIVE	N+1.68	F15	Floor	Gravity	5.0000
LIVE	N+1.68	F16	Floor	Gravity	5.0000
LIVE	N+1.08	F14	Floor	Gravity	5.0000
LIVE	N+0.5	F13	Floor	Gravity	5.0000

9.1.1 DATOS DE SALIDA

BEAM FORCES
UNID: kN-m

Story	Beam	Load	Loc	P	V2	T	M3
BASE	B125	ENVOLVENTE MAX	0	0	3.16	68.536	-0.504
BASE	B125	ENVOLVENTE MAX	0.225	0	4.37	68.536	-0.918
BASE	B125	ENVOLVENTE MAX	0.225	0	-3.09	29.461	-0.668
BASE	B125	ENVOLVENTE MAX	1.125	0	0.42	29.461	1.207
BASE	B125	ENVOLVENTE MAX	2.25	0	5.6	29.461	-0.418
BASE	B125	ENVOLVENTE MIN	0	0	1.45	20.179	-1.025
BASE	B125	ENVOLVENTE MIN	0.225	0	2.23	20.179	-1.872
BASE	B125	ENVOLVENTE MIN	0.225	0	-5.47	6.928	-1.534
BASE	B125	ENVOLVENTE MIN	1.125	0	-0.83	6.928	0.713
BASE	B125	ENVOLVENTE MIN	2.25	0	3.06	6.928	-2.58
N+0.5	B126	ENVOLVENTE MAX	0	0	103.43	19.553	3.826
N+0.5	B126	ENVOLVENTE MAX	1.125	0	117.19	19.553	-39.564
N+0.5	B126	ENVOLVENTE MAX	2.025	0	127.22	19.553	-78.354
N+0.5	B126	ENVOLVENTE MAX	2.025	0	233.29	50.109	-79.754
N+0.5	B126	ENVOLVENTE MAX	2.25	0	234.46	50.109	-98.47
N+0.5	B126	ENVOLVENTE MIN	0	0	31.53	0.42	0.514
N+0.5	B126	ENVOLVENTE MIN	1.125	0	40.27	0.42	-119.106
N+0.5	B126	ENVOLVENTE MIN	2.025	0	45.36	0.42	-229.894
N+0.5	B126	ENVOLVENTE MIN	2.025	0	82.11	2.078	-235.088
N+0.5	B126	ENVOLVENTE MIN	2.25	0	82.99	2.078	-287.71
N+1.08	B127	ENVOLVENTE MAX	0	0	120.1	7.861	3.619
N+1.08	B127	ENVOLVENTE MAX	1.125	0	133.86	7.861	-45.236
N+1.08	B127	ENVOLVENTE MAX	2.025	0	143.99	7.861	-88.798
N+1.08	B127	ENVOLVENTE MAX	2.025	0	267.73	35.742	-90.288
N+1.08	B127	ENVOLVENTE MAX	2.25	0	268.9	35.742	-111.972
N+1.08	B127	ENVOLVENTE MIN	0	0	38.93	-4.584	-0.002
N+1.08	B127	ENVOLVENTE MIN	1.125	0	45.57	-4.584	-138.453
N+1.08	B127	ENVOLVENTE MIN	2.025	0	50.66	-4.584	-264.244
N+1.08	B127	ENVOLVENTE MIN	2.025	0	93.5	-22.988	-271.372
N+1.08	B127	ENVOLVENTE MIN	2.25	0	94.37	-22.988	-331.743
N+2.26	B130	ENVOLVENTE MAX	0	0	-94.63	23.522	-107.84
N+2.26	B130	ENVOLVENTE MAX	0.23	0	-93.74	23.522	-85.98
N+2.26	B130	ENVOLVENTE MAX	0.23	0	-51.05	14.119	-85.813
N+2.26	B130	ENVOLVENTE MAX	1.08	0	-46.25	14.119	-43.71
N+2.26	B130	ENVOLVENTE MAX	2.18	0	-39.76	14.119	4.278
N+2.26	B130	ENVOLVENTE MIN	0	0	-263.66	-24.954	-317.118
N+2.26	B130	ENVOLVENTE MIN	0.23	0	-262.47	-24.954	-256.613
N+2.26	B130	ENVOLVENTE MIN	0.23	0	-140.75	-5.501	-249.906
N+2.26	B130	ENVOLVENTE MIN	1.08	0	-131.38	-5.501	-132.183
N+2.26	B130	ENVOLVENTE MIN	2.18	0	-118.2	-5.501	-1.205
N+2.86	B131	ENVOLVENTE MAX	0	74.37	-79.48	12.144	-81.995
N+2.86	B131	ENVOLVENTE MAX	0.23	74.37	-78.59	12.144	-63.633
N+2.86	B131	ENVOLVENTE MAX	0.23	27.08	-39.93	13.425	-64.988
N+2.86	B131	ENVOLVENTE MAX	1.08	27.08	-35.12	13.425	-32.492
N+2.86	B131	ENVOLVENTE MAX	2.18	27.08	-28.84	13.425	2.988
N+2.86	B131	ENVOLVENTE MIN	0	-74.47	-227.63	-61.529	-277.782
N+2.86	B131	ENVOLVENTE MIN	0.23	-74.47	-226.44	-61.529	-225.563
N+2.86	B131	ENVOLVENTE MIN	0.23	-26.14	-125.51	-19.237	-221.836
N+2.86	B131	ENVOLVENTE MIN	1.08	-26.14	-116.14	-19.237	-117.225
N+2.86	B131	ENVOLVENTE MIN	2.18	-26.14	-102.96	-19.237	-2.108
N+3.5	B132	ENVOLVENTE MAX	0	0	0	0	0
N+3.5	B132	ENVOLVENTE MAX	0.225	0	1.36	0	-0.098
N+3.5	B132	ENVOLVENTE MAX	0.225	0	-33.25	16.947	-61.26
N+3.5	B132	ENVOLVENTE MAX	1.548	0	-24.88	16.947	-22.188
N+3.5	B132	ENVOLVENTE MAX	2.405	0	-20.1	16.947	-1.306
N+3.5	B132	ENVOLVENTE MAX	2.405	0	-4.65	9.939	-0.932
N+3.5	B132	ENVOLVENTE MAX	3.095	0	-1.5	9.939	1.805
N+3.5	B132	ENVOLVENTE MIN	0	0	0	0	0
N+3.5	B132	ENVOLVENTE MIN	0.225	0	0.87	0	-0.153
N+3.5	B132	ENVOLVENTE MIN	0.225	0	-113.85	-8.297	-221.884
N+3.5	B132	ENVOLVENTE MIN	1.548	0	-96.18	-8.297	-80.891
N+3.5	B132	ENVOLVENTE MIN	2.405	0	-86.86	-8.297	-4.047
N+3.5	B132	ENVOLVENTE MIN	2.405	0	-13.8	4.003	-7.535
N+3.5	B132	ENVOLVENTE MIN	3.095	0	-9	4.003	-0.284
N+3.5	B133	ENVOLVENTE MAX	0	0	-24.05	-16.121	-33.019
N+3.5	B133	ENVOLVENTE MAX	1.015	0	-18.07	-16.121	-11.231
N+3.5	B133	ENVOLVENTE MAX	2.03	0	-12.09	-16.121	5.08
N+3.5	B133	ENVOLVENTE MIN	0	0	-53.8	-42.589	-82.829
N+3.5	B133	ENVOLVENTE MIN	1.015	0	-41.7	-42.589	-35.041
N+3.5	B133	ENVOLVENTE MIN	2.03	0	-29.6	-42.589	-4.111
N+3.5	B134	ENVOLVENTE MAX	0	0	-12.08	4.111	-16.121
N+3.5	B134	ENVOLVENTE MAX	1.435	0	-2.83	4.111	-2.668
N+3.5	B134	ENVOLVENTE MAX	2.18	0	1.06	4.111	0.31
N+3.5	B134	ENVOLVENTE MAX	2.18	0	-2.03	2.5	-0.03
N+3.5	B134	ENVOLVENTE MAX	2.87	0	1.13	2.5	0.284
N+3.5	B134	ENVOLVENTE MIN	0	0	-29.6	-5.08	-42.589
N+3.5	B134	ENVOLVENTE MIN	1.435	0	-10.08	-5.08	-12.021
N+3.5	B134	ENVOLVENTE MIN	2.18	0	-3.96	-5.08	-9.341
N+3.5	B134	ENVOLVENTE MIN	2.18	0	-10.6	-10.255	-7.461
N+3.5	B134	ENVOLVENTE MIN	2.87	0	-5.8	-10.255	-1.805
N+1.68	B135	ENVOLVENTE MAX	0	0	84.05	0.341	3.984
N+1.68	B135	ENVOLVENTE MAX	1.125	0	98.11	0.341	-28.912
N+1.68	B135	ENVOLVENTE MAX	2.025	0	108.15	0.341	-59.346

N+1.68	B135	ENVOLVENTE MAX	2.025	0	213.31	9.323	-59.217
N+1.68	B135	ENVOLVENTE MAX	2.25	0	214.81	9.323	-78.104
N+1.68	B135	ENVOLVENTE MIN	0	0	24.17	-26.698	1.144
N+1.68	B135	ENVOLVENTE MIN	1.125	0	31	-26.698	-96.995
N+1.68	B135	ENVOLVENTE MIN	2.025	0	36.1	-26.698	-190.62
N+1.68	B135	ENVOLVENTE MIN	2.025	0	75.07	-39.232	-191.778
N+1.68	B135	ENVOLVENTE MIN	2.25	0	76.05	-39.232	-239.928
N+1.68	B136	ENVOLVENTE MAX	0	0	-75.97	43.048	-78.327
N+1.68	B136	ENVOLVENTE MAX	0.23	0	-74.97	43.048	-60.714
N+1.68	B136	ENVOLVENTE MAX	0.23	0	-36.65	30.473	-59.934
N+1.68	B136	ENVOLVENTE MAX	1.09	0	-31.84	30.473	-30.237
N+1.68	B136	ENVOLVENTE MAX	2.18	0	-25.31	30.473	3.972
N+1.68	B136	ENVOLVENTE MIN	0	0	-217.28	-5.312	-242.502
N+1.68	B136	ENVOLVENTE MIN	0.23	0	-215.74	-5.312	-192.718
N+1.68	B136	ENVOLVENTE MIN	0.23	0	-110.88	3.235	-190.908
N+1.68	B136	ENVOLVENTE MIN	1.09	0	-101.52	3.235	-98.874
N+1.68	B136	ENVOLVENTE MIN	2.18	0	-88.14	3.235	-0.163
N+0.5	B137	ENVOLVENTE MAX	0	0	41.16	1.759	17.687
N+0.5	B137	ENVOLVENTE MAX	0.86	0	47.67	1.759	-3.965
N+0.5	B137	ENVOLVENTE MAX	1.72	0	55.08	1.759	-16.407
N+0.5	B137	ENVOLVENTE MIN	0	0	5.17	-0.46	-4.551
N+0.5	B137	ENVOLVENTE MIN	0.86	0	8.65	-0.46	-26.482
N+0.5	B137	ENVOLVENTE MIN	1.72	0	12.14	-0.46	-71.278
N+0.5	B138	ENVOLVENTE MAX	0	0	-1.41	1.347	0.482
N+0.5	B138	ENVOLVENTE MAX	1.013	0	3.19	1.347	0.944
N+0.5	B138	ENVOLVENTE MAX	2.025	0	11.27	1.347	-1.638
N+0.5	B138	ENVOLVENTE MIN	0	0	-5.98	-0.696	-2.609
N+0.5	B138	ENVOLVENTE MIN	1.013	0	0.02	-0.696	0.22
N+0.5	B138	ENVOLVENTE MIN	2.025	0	3.47	-0.696	-7.184
N+0.5	B139	ENVOLVENTE MAX	0	0	41.38	-1.309	4.864
N+0.5	B139	ENVOLVENTE MAX	0.86	0	48.99	-1.309	-7.067
N+0.5	B139	ENVOLVENTE MAX	1.72	0	56.6	-1.309	-19.406
N+0.5	B139	ENVOLVENTE MIN	0	0	8.8	-5.73	0.884
N+0.5	B139	ENVOLVENTE MIN	0.86	0	12.29	-5.73	-33.82
N+0.5	B139	ENVOLVENTE MIN	1.72	0	15.78	-5.73	-79.925
N+1.08	B140	ENVOLVENTE MAX	0	0	44.27	2.578	10.683
N+1.08	B140	ENVOLVENTE MAX	0.86	0	51.88	2.578	-7.278
N+1.08	B140	ENVOLVENTE MAX	1.72	0	59.49	2.578	-21.177
N+1.08	B140	ENVOLVENTE MIN	0	0	7.58	0.116	-6.452
N+1.08	B140	ENVOLVENTE MIN	0.86	0	11.07	0.116	-37.852
N+1.08	B140	ENVOLVENTE MIN	1.72	0	14.56	0.116	-86.447
N+1.08	B141	ENVOLVENTE MAX	0	0	-1.25	1.02	0.575
N+1.08	B141	ENVOLVENTE MAX	1.013	0	3.44	1.02	0.782
N+1.08	B141	ENVOLVENTE MAX	2.025	0	11.42	1.02	-1.797
N+1.08	B141	ENVOLVENTE MIN	0	0	-6	-0.967	-2.848
N+1.08	B141	ENVOLVENTE MIN	1.013	0	-0.11	-0.967	0.089
N+1.08	B141	ENVOLVENTE MIN	2.025	0	3.34	-0.967	-7.543
N+1.08	B142	ENVOLVENTE MAX	0	0	46.77	-1.199	3.12
N+1.08	B142	ENVOLVENTE MAX	0.86	0	53.27	-1.199	-4.66
N+1.08	B142	ENVOLVENTE MAX	1.72	0	59.77	-1.199	-13.112
N+1.08	B142	ENVOLVENTE MIN	0	0	4.28	-5.662	-0.99
N+1.08	B142	ENVOLVENTE MIN	0.86	0	7.77	-5.662	-40.65
N+1.08	B142	ENVOLVENTE MIN	1.72	0	11.26	-5.662	-89.737
N+1.68	B143	ENVOLVENTE MAX	0	0	4.66	4.209	-0.873
N+1.68	B143	ENVOLVENTE MAX	1.125	0	16.13	4.209	-4.029
N+1.68	B143	ENVOLVENTE MAX	2.25	0	27.98	4.209	-13.684
N+1.68	B143	ENVOLVENTE MIN	0	0	0.43	1.072	-3.347
N+1.68	B143	ENVOLVENTE MIN	1.125	0	5.56	1.072	-13.294
N+1.68	B143	ENVOLVENTE MIN	2.25	0	10.69	1.072	-39.634
N+2.26	B146	ENVOLVENTE MAX	0	0	43.75	4.02	5.898
N+2.26	B146	ENVOLVENTE MAX	0.86	0	51.36	4.02	-6.135
N+2.26	B146	ENVOLVENTE MAX	1.72	0	58.97	4.02	-19.248
N+2.26	B146	ENVOLVENTE MIN	0	0	9.1	0.697	-3.186
N+2.26	B146	ENVOLVENTE MIN	0.86	0	12.59	0.697	-38.866
N+2.26	B146	ENVOLVENTE MIN	1.72	0	16.08	0.697	-87.011
N+2.26	B147	ENVOLVENTE MAX	0	0	39.24	-0.615	9.719
N+2.26	B147	ENVOLVENTE MAX	0.86	0	46.85	-0.615	-3.298
N+2.26	B147	ENVOLVENTE MAX	1.72	0	54.46	-0.615	-15.007
N+2.26	B147	ENVOLVENTE MIN	0	0	6.33	-3.301	-5.606
N+2.26	B147	ENVOLVENTE MIN	0.86	0	9.82	-3.301	-35.129
N+2.26	B147	ENVOLVENTE MIN	1.72	0	13.31	-3.301	-77.996
N+2.26	B148	ENVOLVENTE MAX	0	0	-1.58	1.961	0.085
N+2.26	B148	ENVOLVENTE MAX	0.975	0	2.91	1.961	0.42
N+2.26	B148	ENVOLVENTE MAX	1.95	0	10.87	1.961	-2.058
N+2.26	B148	ENVOLVENTE MIN	0	0	-5.36	-0.369	-2.125
N+2.26	B148	ENVOLVENTE MIN	0.975	0	0.33	-0.369	0.103
N+2.26	B148	ENVOLVENTE MIN	1.95	0	3.61	-0.369	-7.027
N+2.86	B149	ENVOLVENTE MAX	0	40.3	36.52	0.593	19.404
N+2.86	B149	ENVOLVENTE MAX	0.86	40.3	44.13	0.593	1.2
N+2.86	B149	ENVOLVENTE MAX	1.72	40.3	51.75	0.593	-12.112
N+2.86	B149	ENVOLVENTE MIN	0	-42.33	6.12	-3.446	-8.529
N+2.86	B149	ENVOLVENTE MIN	0.86	-42.33	9.61	-3.446	-30.322
N+2.86	B149	ENVOLVENTE MIN	1.72	-42.33	13.1	-3.446	-67.192
N+2.86	B150	ENVOLVENTE MAX	0	3.79	-1.28	2.087	0.633
N+2.86	B150	ENVOLVENTE MAX	0.975	3.79	3.04	2.087	0.922
N+2.86	B150	ENVOLVENTE MAX	1.95	3.79	10.49	2.087	-1.657
N+2.86	B150	ENVOLVENTE MIN	0	-2.95	-5.91	-1.073	-2.943
N+2.86	B150	ENVOLVENTE MIN	0.975	-2.95	-0.24	-1.073	-0.04
N+2.86	B150	ENVOLVENTE MIN	1.95	-2.95	3.03	-1.073	-6.513
N+2.86	B151	ENVOLVENTE MAX	0	37.58	42.75	4.557	7.365

[illegible]	B151	ENVOLVENTE MAX	0.86	37.58	49.88	4.557	-5.28
N+2.86	B151	ENVOLVENTE MAX	1.72	37.58	57.49	4.557	-16.407
N+2.86	B151	ENVOLVENTE MIN	0	-44.66	7.07	0.328	-0.582
N+2.86	B151	ENVOLVENTE MIN	0.86	-44.66	10.56	0.328	-34.322
N+2.86	B151	ENVOLVENTE MIN	1.72	-44.66	14.05	0.328	-80.917
N+3.5	B152	ENVOLVENTE MAX	0	0	-8.84	1.883	-6.848
N+3.5	B152	ENVOLVENTE MAX	1,015	0	-4.17	1.883	0.193
N+3.5	B152	ENVOLVENTE MAX	2.03	0	0.48	1.883	5.175
N+3.5	B152	ENVOLVENTE MIN	0	0	-32.2	-0.343	-36.39
N+3.5	B152	ENVOLVENTE MIN	1,015	0	-20.47	-0.343	-9.279
N+3.5	B152	ENVOLVENTE MIN	2.03	0	-10.22	-0.343	1.61
N+1.68	B153	ENVOLVENTE MAX	0	0	4.23	-1.3	-1.131
N+1.68	B153	ENVOLVENTE MAX	1,125	0	15.75	-1.3	-4.306
N+1.68	B153	ENVOLVENTE MAX	2.25	0	27.53	-1.3	-13.915
N+1.68	B153	ENVOLVENTE MIN	0	0	0.46	-4.739	-3.915
N+1.68	B153	ENVOLVENTE MIN	1,125	0	5.57	-4.739	-13.501
N+1.68	B153	ENVOLVENTE MIN	2.25	0	10.88	-4.739	-39.342
N+1.68	B154	ENVOLVENTE MAX	0	0	16.27	0,023	3.588
N+1.68	B154	ENVOLVENTE MAX	1,125	0	29.76	0,023	-6.572
N+1.68	B154	ENVOLVENTE MAX	2.25	0	43.24	0,023	-25.338
N+1.68	B154	ENVOLVENTE MIN	0	0	6.94	-1.581	1.113
N+1.68	B154	ENVOLVENTE MIN	1,125	0	11.95	-1.581	-20.634
N+1.68	B154	ENVOLVENTE MIN	2.25	0	16.95	-1.581	-63.361
N+1.68	B155	ENVOLVENTE MAX	0	0	16.33	1,063	3.674
N+1.68	B155	ENVOLVENTE MAX	1,125	0	29.88	1,063	-6.193
N+1.68	B155	ENVOLVENTE MAX	2.25	0	43.44	1,063	-24.196
N+1.68	B155	ENVOLVENTE MIN	0	0	6.23	-0,324	1.118
N+1.68	B155	ENVOLVENTE MIN	1,125	0	11.26	-0,324	-20.624
N+1.68	B155	ENVOLVENTE MIN	2.25	0	16.29	-0,324	-63.565
N+1.68	B156	ENVOLVENTE MAX	0	0	-0.43	-0,873	-1.072
N+1.68	B156	ENVOLVENTE MAX	2.025	0	15.69	-0,873	-5.048
N+1.68	B156	ENVOLVENTE MAX	2.025	0	0.12	0,811	-5.542
N+1.68	B156	ENVOLVENTE MAX	2.215	0	0.75	0,811	-5.571
N+1.68	B156	ENVOLVENTE MAX	2.48	0	1.93	0,811	-5.737
N+1.68	B156	ENVOLVENTE MAX	2.48	0	-5.86	3,915	-5.418
N+1.68	B156	ENVOLVENTE MAX	4.43	0	4.23	3,915	-1.3
N+1.68	B156	ENVOLVENTE MIN	0	0	-4.66	-3,347	-4.209
N+1.68	B156	ENVOLVENTE MIN	2.025	0	6.04	-3,347	-15.769
N+1.68	B156	ENVOLVENTE MIN	2.025	0	-1.25	-0,408	-16.395
N+1.68	B156	ENVOLVENTE MIN	2.215	0	-0.58	-0,408	-16.346
N+1.68	B156	ENVOLVENTE MIN	2.48	0	0.18	-0,408	-16.587
N+1.68	B156	ENVOLVENTE MIN	2.48	0	-14.79	1.131	-15.294
N+1.68	B156	ENVOLVENTE MIN	4.43	0	0.46	1.131	-4.739
N+3.5	B157	ENVOLVENTE MAX	0	0	-1.5	1.805	-4.003
N+3.5	B157	ENVOLVENTE MAX	1.015	0	1.13	1.805	0.188
N+3.5	B157	ENVOLVENTE MAX	2.03	0	5.8	1.805	2.5
N+3.5	B157	ENVOLVENTE MIN	0	0	-9	-0,284	-9.939
N+3.5	B157	ENVOLVENTE MIN	1.015	0	-4.04	-0,284	-6.714
N+3.5	B157	ENVOLVENTE MIN	2.03	0	-1.13	-0,284	-10.285

FUERZAS EN COLUMNAS

COLUMN FORCES
UNID: kN-m

Story	Column	Load	Loc	P	V2	V3	T	M2	M3
N+2.86	C36	ENVOLVENTE MAX	0,000	-82.720	62.170	84.220	37.853	277.771	4.187
N+2.86	C36	ENVOLVENTE MAX	0,300	-81.100	62.170	84.220	37.853	277.776	7.932
N+2.86	C36	ENVOLVENTE MAX	0,600	-79.480	62.170	84.220	37.853	277.782	12.144
N+2.86	C36	ENVOLVENTE MIN	0,000	-231.950	-15.260	-84.320	-46.553	62.770	-25.427
N+2.86	C36	ENVOLVENTE MIN	0,300	-229.790	-15.260	-84.320	-46.553	81.199	-43.244
N+2.86	C36	ENVOLVENTE MIN	0,600	-227.630	-15.260	-84.320	-46.553	81.995	-61.529
N+2.26	C36	ENVOLVENTE MAX	0,000	-85.850	64.830	87.940	37.853	317.404	15.252
N+2.26	C36	ENVOLVENTE MAX	0,290	-84.290	64.830	87.940	37.853	294.271	4.394
N+2.26	C36	ENVOLVENTE MAX	0,580	-82.720	64.830	87.940	37.853	277.771	4.187
N+2.26	C36	ENVOLVENTE MIN	0,000	-236.130	-17.920	-88.040	-46.553	17.407	-9.286
N+2.26	C36	ENVOLVENTE MIN	0,290	-234.040	-17.920	-88.040	-46.553	40.649	-12.032
N+2.26	C36	ENVOLVENTE MIN	0,580	-231.950	-17.920	-88.040	-46.553	62.770	-25.427
N+1,68	C36	ENVOLVENTE MAX	0,000	-89.090	66.840	90.320	37.853	369.428	54.183
N+1,68	C36	ENVOLVENTE MAX	0,300	-87.470	66.840	90.320	37.853	342.593	34.472
N+1,68	C36	ENVOLVENTE MAX	0,600	-85.850	66.840	90.320	37.853	317.404	15.252
N+1,68	C36	ENVOLVENTE MIN	0,000	-240.450	-19.930	-90.410	-46.553	-34.594	-20.074
N+1,68	C36	ENVOLVENTE MIN	0,300	-238.290	-19.930	-90.410	-46.553	-7.730	-14.435
N+1,68	C36	ENVOLVENTE MIN	0,600	-236.130	-19.930	-90.410	-46.553	17.407	-9.286
N+1.08	C36	ENVOLVENTE MAX	0.000	-92,220	68.090	91.530	37.853	422.232	93.187
N+1.08	C36	ENVOLVENTE MAX	0,290	-90.660	68.090	91.530	37.853	395.808	73.627
N+1.08	C36	ENVOLVENTE MAX	0,580	-89.090	68.090	91.530	37.853	369.428	54.183
N+1.08	C36	ENVOLVENTE MIN	0,000	-244.630	-21.180	-91.620	-46.553	-87.454	-31.871
N+1.08	C36	ENVOLVENTE MIN	0,290	-242.540	-21.180	-91.620	-46.553	-61.002	-25.914
N+1.08	C36	ENVOLVENTE MIN	0,580	-240.450	-21.180	-91.620	-46.553	-34.594	-20.074
N+0.5	C36	ENVOLVENTE MAX	0.000	-187.930	79.180	99.120	25.670	235.464	85.057
N+0.5	C36	ENVOLVENTE MAX	0.050	-187.660	79.180	99.120	25.670	230.662	81.225
N+0.5	C36	ENVOLVENTE MAX	0.050	-187.660	79.180	99.120	25.670	230.662	81.225
N+0.5	C36	ENVOLVENTE MAX	0,275	-186.440	79.180	99.120	25.670	209.135	64.181
N+0.5	C36	ENVOLVENTE MAX	0,550	-184.960	79.180	99.120	25.670	183.054	44.305
N+0.5	C36	ENVOLVENTE MIN	0.000	-483.050	-79.900	-99.070	-65.542	-246.518	-76.320
N+0.5	C36	ENVOLVENTE MIN	0.050	-482.690	-79.900	-99.070	-65.542	-241.718	-72.453
N+0.5	C36	ENVOLVENTE MIN	0,050	-482.690	-79.900	-99.070	-65.542	-241.718	-72.453
N+0.5	C36	ENVOLVENTE MIN	0,275	-481.070	-79.900	-99.070	-65.542	-220.201	-55.249

[illegible]	[illegible]	ENVOLVENTE MIN	0.550	-479.090	-79.900	-99.070	-65.542	-194.132	-35.176
N+3.5	C37	ENVOLVENTE MAX	0.000	-85.500	10.150	107.660	34.557	272.021	42.221
N+3.5	C37	ENVOLVENTE MAX	0.320	-83.770	10.150	107.660	34.557	265.431	46.513
N+3.5	C37	ENVOLVENTE MAX	0.640	-82.040	10.150	107.660	34.557	265.745	51.880
N+3.5	C37	ENVOLVENTE MIN	0.000	-223.420	-23.570	-108.730	-49.253	61.488	3.162
N+3.5	C37	ENVOLVENTE MIN	0.320	-221.120	-23.570	-108.730	-49.253	88.697	3.163
N+3.5	C37	ENVOLVENTE MIN	0.640	-218.820	-23.570	-108.730	-49.253	77.502	2.090
N+2.86	C37	ENVOLVENTE MAX	0.000	-88.740	12.980	111.090	34.557	335.413	37.022
N+2.86	C37	ENVOLVENTE MAX	0.300	-87.120	12.980	111.090	34.557	303.311	38.847
N+2.86	C37	ENVOLVENTE MAX	0.600	-85.500	12.980	111.090	34.557	272.021	42.221
N+2.86	C37	ENVOLVENTE MIN	0.000	-227.740	-26.400	-112.160	-49.253	-2.548	0.310
N+2.86	C37	ENVOLVENTE MIN	0.300	-225.580	-26.400	-112.160	-49.253	29.876	2.311
N+2.86	C37	ENVOLVENTE MIN	0.600	-223.420	-26.400	-112.160	-49.253	61.488	3.162
N+2.26	C37	ENVOLVENTE MAX	0.000	-91.870	15.390	113.520	34.557	399.507	38.371
N+2.26	C37	ENVOLVENTE MAX	0.290	-90.310	15.390	113.520	34.557	367.372	36.423
N+2.26	C37	ENVOLVENTE MAX	0.580	-88.740	15.390	113.520	34.557	335.413	37.022
N+2.26	C37	ENVOLVENTE MIN	0.000	-231.920	-28.800	-114.590	-49.253	-67.265	-8.821
N+2.26	C37	ENVOLVENTE MIN	0.290	-229.830	-28.800	-114.590	-49.253	-34.818	-2.982
N+2.26	C37	ENVOLVENTE MIN	0.580	-227.740	-28.800	-114.590	-49.253	-2.548	0.310
N+1.68	C37	ENVOLVENTE MAX	0.000	-95.110	17.590	115.430	34.557	467.158	46.529
N+1.68	C37	ENVOLVENTE MAX	0.300	-93.490	17.590	115.430	34.557	433.274	42.182
N+1.68	C37	ENVOLVENTE MAX	0.600	-91.870	17.590	115.430	34.557	399.507	38.371
N+1.68	C37	ENVOLVENTE MIN	0.000	-236.240	-31.010	-116.500	-49.253	-135.559	-25.029
N+1.68	C37	ENVOLVENTE MIN	0.300	-234.080	-31.010	-116.500	-49.253	-101.353	-16.658
N+1.68	C37	ENVOLVENTE MIN	0.600	-231.920	-31.010	-116.500	-49.253	-67.265	-8.821
N+1.08	C37	ENVOLVENTE MAX	0.000	-98.240	19.180	116.650	34.557	533.716	56.152
N+1.08	C37	ENVOLVENTE MAX	0.290	-96.680	19.180	116.650	34.557	500.356	51.220
N+1.08	C37	ENVOLVENTE MAX	0.580	-95.110	19.180	116.650	34.557	467.158	46.529
N+1.08	C37	ENVOLVENTE MIN	0.000	-240.420	-32.600	-117.730	-49.253	-202.740	-42.435
N+1.08	C37	ENVOLVENTE MIN	0.290	-238.330	-32.600	-117.730	-49.253	-169.068	-33.612
N+1.08	C37	ENVOLVENTE MIN	0.580	-236.240	-32.600	-117.730	-49.253	-135.559	-25.029
N+0.5	C37	ENVOLVENTE MAX	0.000	-101.210	19.810	117.070	34.557	597.281	66.070
N+0.5	C37	ENVOLVENTE MAX	0.050	-100.940	19.810	117.070	34.557	591.494	65.151
N+0.5	C37	ENVOLVENTE MAX	0.050	-100.940	19.810	117.070	34.557	591.494	65.151
N+0.5	C37	ENVOLVENTE MAX	0.275	-99.730	19.810	117.070	34.557	565.472	61.054
N+0.5	C37	ENVOLVENTE MAX	0.550	-98.240	19.810	117.070	34.557	533.716	56.152
N+0.5	C37	ENVOLVENTE MIN	0.000	-244.380	-33.230	-118.150	-49.253	-268.894	-59.732
N+0.5	C37	ENVOLVENTE MIN	0.050	-244.020	-33.230	-118.150	-49.253	-261.054	-58.143
N+0.5	C37	ENVOLVENTE MIN	0.050	-244.020	-33.230	-118.150	-49.253	-261.054	-58.143
N+0.5	C37	ENVOLVENTE MIN	0.275	-242.400	-33.230	-118.150	-49.253	-234.791	-51.027
N+0.5	C37	ENVOLVENTE MIN	0.550	-240.420	-33.230	-118.150	-49.253	-202.740	-42.435
N+2.26	C38	ENVOLVENTE MAX	0.000	-97.760	56.170	100.380	59.046	317.661	13.484
N+2.26	C38	ENVOLVENTE MAX	0.290	-96.200	56.170	100.380	59.046	317.389	15.093
N+2.26	C38	ENVOLVENTE MAX	0.580	-94.630	56.170	100.380	59.046	317.118	23.522
N+2.26	C38	ENVOLVENTE MIN	0.000	-267.840	-38.330	-99.270	-68.689	68.578	-4.572
N+2.26	C38	ENVOLVENTE MIN	0.290	-265.750	-38.330	-99.270	-68.689	95.970	-11.353
N+2.26	C38	ENVOLVENTE MIN	0.580	-263.660	-38.330	-99.270	-68.689	107.840	-24.954
N+1.68	C38	ENVOLVENTE MAX	0.000	-101.000	57.680	104.280	59.046	373.810	44.290
N+1.68	C38	ENVOLVENTE MAX	0.300	-99.380	57.680	104.280	59.046	342.740	27.527
N+1.68	C38	ENVOLVENTE MAX	0.600	-97.760	57.680	104.280	59.046	317.661	13.484
N+1.68	C38	ENVOLVENTE MIN	0.000	-272.160	-39.850	-103.170	-68.689	7.355	-24.678
N+1.68	C38	ENVOLVENTE MIN	0.300	-270.000	-39.850	-103.170	-68.689	38.092	-13.265
N+1.68	C38	ENVOLVENTE MIN	0.600	-267.840	-39.850	-103.170	-68.689	68.578	-4.572
N+1.08	C38	ENVOLVENTE MAX	0.000	-201.710	114.120	136.090	40.294	173.276	67.421

10 BIBLIOGRAFIA

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