

MEMORIA DE CÁLCULO ESTRUCTURAL



GOBERNACIÓN DEL
CESAR

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN
DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA,
MUNICIPIO DE ASTREA - CESAR

ZONA ACCESO - PORTERIA

NORMA DE DISEÑO
NSR-10

William Fuentes

INGENIERO CALCULISTA

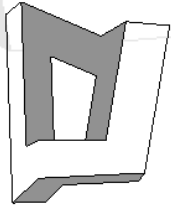
ING. WILLIAM FUENTES LACOUTURE

M.P. 25202150640 CND

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA



MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN
DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA,
MUNICIPIO DE ASTREA - CESAR

ZONA ACCESO - PORTERIA

CONTROL DE REVISIONES

REV	FECHA	DESCRIPCIÓN
1	06/26	Edición Inicial

CONTROL DE COPIAS

NUMERO	DESTINATARIO
1	Propietario/Responsable

Elaboró: Ing. – INGENIERO CALCULISTA ING. WILLIAM FUENTES LACOUTURE M.P. 25202150640 CND	Revisó: Ing. I, Civil M.P.

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Contenido

LOCALIZACIÓN	5
NORMAS	5
DESCRIPCIÓN DE LA ESTRUCTURA	5
PARÁMETROS DE DISEÑO SÍSMICO	6
CARACTERÍSTICAS DE MATERIALES	7
Resistencia a compresión del concreto	7
Módulo de elasticidad del concreto	7
Acero de refuerzo	7
CARGAS	7
IDENTIFICACIÓN DE CARGAS EN MODELO	8
COMBINACIONES DE CARGA	8
MODELO ANÁLITICO	10
CARGAS INCLUIDAS EN EL MODELO	11
ANÁLISIS SÍSMICO	17
Verificación de fuerza sísmica en la base	17
Porcentaje de participación de masas	17
VERIFICACIÓN DE REQUISITOS ESPECIALES ACORDE AL CAPITULO A.12 NSR-10	19
DERIVAS POR UMBRAL DE DAÑO	20
ANÁLISIS DE IRREGULARIDADES	22
Irregularidades en planta	22
Irregularidades en altura	24
Ausencia de redundancia	25
VERIFICACIÓN DE DEFLEXIONES	26
DISEÑO DE ELEMENTOS ESTRUCTURALES	27
Diseño de elementos en concreto reforzado	27

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL
DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR -
ZONA PORTERIA

Diseño de elementos metálicos en cubierta.....	27
Diseño de elementos de cimentación.	54

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

LOCALIZACIÓN

El presente proyecto se refiere a los MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR.

NORMAS

Ley 400 de 1997 y sus decretos reglamentarios

- Decreto 926 del 19 de marzo de 2010
- Decreto 2525 del 13 de julio de 2010
- Decreto 092 del 17 de enero de 2011
- Decreto 340 del 13 de febrero de 2012
- Decreto 945 del 5 de junio de 2017
- Decreto 2113 del 25 de noviembre de 2019
- Resolución 0017 del 4 de diciembre de 2017

DESCRIPCIÓN DE LA ESTRUCTURA

La estructura de la zona de acceso junto a la porteria se compone por sistema estructural porticado en perfiles PTE. La cimentación será superficial. La cubierta será liviana.

CIMENTACIÓN

“Dada las características del proyecto se considera entonces viable el uso de un sistema de cimentación superficial para la transmisión de las cargas de las estructuras al terreno por medio de zapatas desplantadas a una profundidad mínima de 1.20 metros y unidas entre sí por vigas de amarre diseñadas por el ingeniero estructural. La capacidad admisible del terreno será de 16.0 Ton/m².”

SISTEMA ESTRUCTURAL

Sistema de pórticos.

SISTEMA DE RESISTENCIA SÍSMICA

Porticos en perfiles tubulares PTE.

COEFICIENTE DE DISIPACIÓN DE ENERGÍA BÁSICO

1.50

FACTOR DE SOBRE RESISTENCIA

1.50

ALTURA MÁXIMA

12.0 m.

GRADO DE CAPACIDAD DE DISIPACIÓN DE ENERGÍA

Mínimo - DMI

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

PARÁMETROS DE DISEÑO SÍSMICO

PERFIL DE SUELO	D
ACELERACIÓN HORIZONTAL PICO EFECTIVA A_a	0.10
VELOCIDAD HORIZONTAL PICO EFECTIVA A_v	0.10
COEFICIENTE DE AMPLIACIÓN SÍSMICA EN PERIODOS CORTOS F_a	1.60
COEFICIENTE DE AMPLIACIÓN SÍSMICA EN PERIODOS MEDIOS F_v	2.40
GRUPO DE USO	III – Estructuras de atención a la comunidad
COEFICIENTE DE IMPORTANCIA	1.25

ESPECTRO DE DISEÑO						
UBICACIÓN	Astrea - Cesar					
DATOS						
GRUPO DE USO	III	COEFICIENTE DE IMPORTANCIA			1.25	
PERFIL DE SUELO	D	Fa	1.6	Fv	2.4	
AaFal	0.2	Aa	0.1	Av	0.1	
Sa	0.5	T0	0.15	Tc	0.72	
T (s)	Sad (g)					
0	0.200					
0.15	0.500					
0.72	0.500					
1.07	0.336					
1.42	0.254					
1.77	0.203					
2.12	0.170					
2.47	0.146					
2.82	0.128					
3.17	0.114					
3.52	0.102					
3.87	0.093					
4.22	0.085					
4.57	0.079					
5.76	0.063					

Espectro de Aceleraciones Horizontales

T (s)	Sad (g)
0	0.200
0.15	0.500
0.72	0.500
1.07	0.336
1.42	0.254
1.77	0.203
2.12	0.170
2.47	0.146
2.82	0.128
3.17	0.114
3.52	0.102
3.87	0.093
4.22	0.085
4.57	0.079
5.76	0.063

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

CARACTERISTICAS DE MATERIALES

Los elementos estructurales de la estructura se analizaron con las siguientes características:

Resistencia a compresión del concreto

La resistencia a la compresión del concreto establecida es de:

Columnas y vigas: 21 MPa.

Cimentación: 21 MPa.

Módulo de elasticidad del concreto

El agregado usado para el concreto estructural deberá ser de origen metamórfico.

Su módulo de elasticidad se calcula según lo indica C.8.5.1.

Módulo de elasticidad del concreto: $3900\sqrt{21\text{MPa}} = 17872.04 \text{ MPa}$

Acero de refuerzo

El refuerzo de los elementos de concreto y muros de perforación vertical consiste en varillas corrugadas de acero con diámetros desde 4mm hasta 1" y las siguientes resistencias a tensión fy.

Varillas de refuerzo: 420 MPa.

Mallas Electrosoldadas: 480 MPa.

Perfiles estructurales Tipo I: ASTM A572 G50 $F_y = 345 \text{ MPa}$ $F_u = 450 \text{ Mpa}$

Tubería estructural: ASTM A500 $F_y = 345 \text{ MPa}$ $F_u = 425 \text{ MPa}$

Platinas: ASTM A36

Tornillos y Pernos: A325

El acero de refuerzo utilizado debe cumplir con la norma NTC-2289, con módulo de elasticidad de 200000 MPa

CARGAS

Peso propio de los elementos estructurales:

Todos los elementos de concreto reforzado: 2400 Kg/m³

Todos los elementos en acero: 7800 Kg/m³

Cargas adicionales al peso propio de los elementos estructurales (gravitacionales):

Carga viva en cubierta: 50 Kg/m²

Carga muerta sobreimpuesta en cubierta: 80 kg/m²

Carga viento a compresión en cubierta: 50 kg/m²

Carga viento a succión en cubierta: 56.08 kg/m²

Carga viento a compresión en fachada de cubierta: 150.26 kg/m²

Carga viento a succión en fachada de cubierta: 114.33 kg/m²

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

IDENTIFICACIÓN DE CARGAS EN MODELO

Condiciones de carga:

- D Carga muerta – Peso Propio
- DS Carga muerta sobreimpuesta
- L Carga Viva
- SX Cargas sísmicas En dirección X
- SY Cargas sísmicas En dirección Y
- W Carga de viento

COMBINACIONES DE CARGA

Name	Load Name	SF	Load Name	SF	Load Name	SF	Load Name	SF
CIM 0.6D	Dead	0.6	DS	0.6				
CIM 0.6D+0.7SX	Dead	0.6	DS	0.6	SX	0.7		
CIM 0.6D+0.7SY	Dead	0.6	DS	0.6	SY	0.7		
CIM 1.0D	Dead	1	DS	1				
CIM 1.0D+0.7SX	Dead	1	DS	1	SX	0.7		
CIM 1.0D+0.7SY	Dead	1	DS	1	SY	0.7		
CIM 1.0D+0.75L+0.5SX	Dead	1	DS	1	Live	0.75	SX	0.5
CIM 1.0D+0.75L+0.5SY	Dead	1	DS	1	Live	0.75	SY	0.5
CIM 1.0D+1.0L	Dead	1	DS	1	Live	1		
DES 0.6D+1.0SX	Dead	0.6	DS	0.6	SX	1		
DES 0.6D+1.0SY	Dead	0.6	DS	0.6	SY	1		
DES 1.0D+0.75L+0.75SX	Dead	1	DS	1	Live	0.75	SX	0.75
DES 1.0D+0.75L+0.75SY	Dead	1	DS	1	Live	0.75	SY	0.75
DES 1.0D+1.0SX	Dead	1	DS	1	SX	1		
DES 1.0D+1.0SY	Dead	1	DS	1	SY	1		
ELS 0.6D+0.7SX	Dead	0.6	DS	0.6	SX	0.7		
ELS 0.6D+0.7SY	Dead	0.6	DS	0.6	SY	0.7		
ELS 0.6D+1.0W1	Dead	0.6	DS	0.6	W1	1		
ELS 0.6D+1.0W2	Dead	0.6	DS	0.6	W2	1		
ELS 1.0D	Dead	1	DS	1				
ELS 1.0D+0.7SX	Dead	1	DS	1	SX	0.7		
ELS 1.0D+0.7SY	Dead	1	DS	1	SY	0.7		
ELS 1.0D+0.75L	Dead	1	DS	1	Live	0.75		
ELS 1.0D+0.75L+0.525SX	Dead	1	DS	1	Live	0.75	SX	0.525
ELS 1.0D+0.75L+0.525SY	Dead	1	DS	1	Live	0.75	SY	0.525

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Name	Load Name	SF	Load Name	SF	Load Name	SF	Load Name	SF
ELS 1.0D+0.75W1+0.75L	Dead	1	DS	1	Live	0.75	W1	0.75
ELS 1.0D+0.75W2+0.75L	Dead	1	DS	1	Live	0.75	W2	0.75
ELS 1.0D+1.0L	Dead	1	DS	1	Live	1		
ELS 1.0D+1.0W1	Dead	1	DS	1	W1	1		
ELS 1.0D+1.0W2	Dead	1	DS	1	W2	1		
ELU 0.9D	Dead	0.9	DS	0.9				
ELU 0.9D-1.0SX-0.3SY	Dead	0.9	DS	0.9	SX	-1	SY	-0.3
ELU 0.9D-1.0SX+0.3SY	Dead	0.9	DS	0.9	SX	-1	SY	0.3
ELU 0.9D-1.0SY-0.3SX	Dead	0.9	DS	0.9	SX	-0.3	SY	-1
ELU 0.9D-1.0SY+0.3SX	Dead	0.9	DS	0.9	SX	0.3	SY	-1
ELU 0.9D+1.0SX-0.3SY	Dead	0.9	DS	0.9	SX	1	SY	-0.3
ELU 0.9D+1.0SX+0.3SY	Dead	0.9	DS	0.9	SX	1	SY	0.3
ELU 0.9D+1.0SY-0.3SX	Dead	0.9	DS	0.9	SX	-0.3	SY	1
ELU 0.9D+1.0SY+0.3SX	Dead	0.9	DS	0.9	SX	0.3	SY	1
ELU 0.9D+1.6W1	Dead	0.9	DS	0.9	W1	1.6		
ELU 0.9D+1.6W2	Dead	0.9	DS	0.9	W2	1.6		
ELU 1.2D+0.8W1	Dead	1.2	DS	1.2	W1	0.8		
ELU 1.2D+0.8W2	Dead	1.2	DS	1.2	W2	0.8		
ELU 1.2D+1.0L-1.0SX-0.3SY	Dead	1.2	DS	1.2	Live	1	SX	-1
ELU 1.2D+1.0L-1.0SX-0.3SY							SY	-0.3
ELU 1.2D+1.0L-1.0SX+0.3SY	Dead	1.2	DS	1.2	Live	1	SX	-1
ELU 1.2D+1.0L-1.0SX+0.3SY							SY	0.3
ELU 1.2D+1.0L-1.0SY-0.3SX	Dead	1.2	DS	1.2	Live	1	SX	-0.3
ELU 1.2D+1.0L-1.0SY-0.3SX							SY	-1
ELU 1.2D+1.0L-1.0SY+0.3SX	Dead	1.2	DS	1.2	Live	1	SX	0.3
ELU 1.2D+1.0L-1.0SY+0.3SX							SY	-1
ELU 1.2D+1.0L+1.0SX-0.3SY	Dead	1.2	DS	1.2	Live	1	SX	1
ELU 1.2D+1.0L+1.0SX-0.3SY							SY	-0.3
ELU 1.2D+1.0L+1.0SX+0.3SY	Dead	1.2	DS	1.2	Live	1	SX	1
ELU 1.2D+1.0L+1.0SX+0.3SY							SY	0.3
ELU 1.2D+1.0L+1.0SY-0.3SX	Dead	1.2	DS	1.2	Live	1	SX	-0.3
ELU 1.2D+1.0L+1.0SY-0.3SX							SY	1
ELU 1.2D+1.0L+1.0SY+0.3SX	Dead	1.2	DS	1.2	Live	1	SX	0.3
ELU 1.2D+1.0L+1.0SY+0.3SX							SY	1
ELU 1.2D+1.6L	Dead	1.2	DS	1.2	Live	1.6		

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL
DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR -
ZONA PORTERIA

Name	Load Name	SF	Load Name	SF	Load Name	SF	Load Name	SF
ELU 1.2D+1.6W1+1.0L	Dead	1.2	DS	1.2	Live	1	W1	1.6
ELU 1.2D+1.6W2+1.0L	Dead	1.2	DS	1.2	Live	1	W2	1.6
ELU 1.4D	Dead	1.4	DS	1.4				

MODELO ANÁLITICO

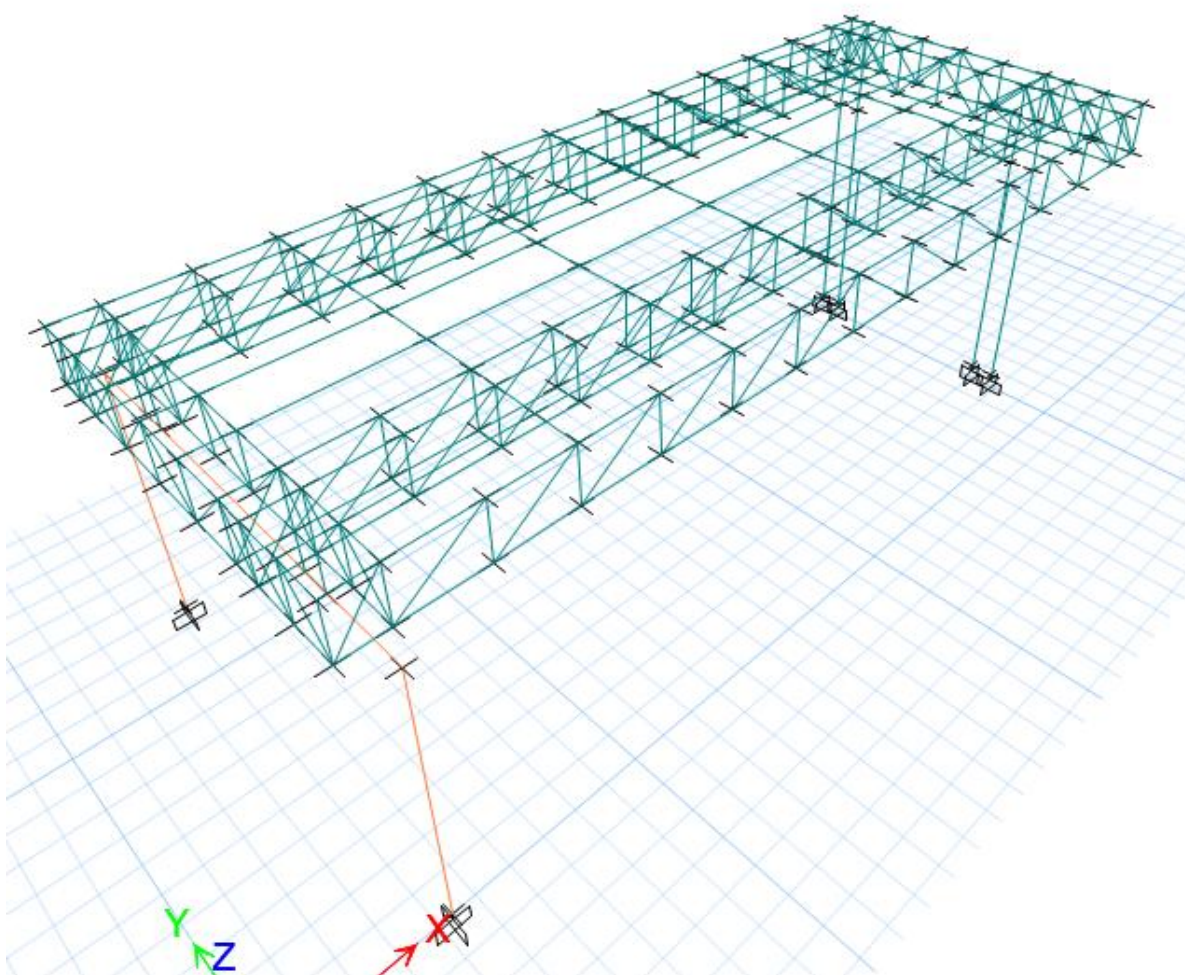


IMAGEN 1: Modelo tridimensional.

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

CARGAS INCLUIDAS EN EL MODELO

Story	Label	Load Pattern	Load Type	Direction	Distance Type	Absolute Distance B	Force A	Force B
						m	kgf/m	kgf/m
Story2	B347	L	Force	Gravity	Relative	0.6	39	39
Story2	B348	L	Force	Gravity	Relative	2.192	39	39
Story2	B349	L	Force	Gravity	Relative	2.192	39	39
Story2	B350	L	Force	Gravity	Relative	2.192	39	39
Story2	B351	L	Force	Gravity	Relative	2.192	39	39
Story2	B352	L	Force	Gravity	Relative	2.192	39	39
Story2	B353	L	Force	Gravity	Relative	2.192	39	39
Story2	B354	L	Force	Gravity	Relative	0.6	39	39
Story2	B355	L	Force	Gravity	Relative	0.6	39	39
Story2	B356	L	Force	Gravity	Relative	2.192	39	39
Story2	B357	L	Force	Gravity	Relative	2.192	39	39
Story2	B358	L	Force	Gravity	Relative	2.192	39	39
Story2	B359	L	Force	Gravity	Relative	2.192	39	39
Story2	B360	L	Force	Gravity	Relative	2.192	39	39
Story2	B361	L	Force	Gravity	Relative	2.192	39	39
Story2	B362	L	Force	Gravity	Relative	0.6	39	39
Story2	B363	L	Force	Gravity	Relative	0.6	39	39
Story2	B364	L	Force	Gravity	Relative	2.192	39	39
Story2	B365	L	Force	Gravity	Relative	2.192	39	39
Story2	B366	L	Force	Gravity	Relative	2.192	39	39
Story2	B367	L	Force	Gravity	Relative	2.192	39	39
Story2	B368	L	Force	Gravity	Relative	2.192	39	39
Story2	B369	L	Force	Gravity	Relative	2.192	39	39
Story2	B370	L	Force	Gravity	Relative	0.6	39	39
Story2	B371	L	Force	Gravity	Relative	0.6	39	39
Story2	B372	L	Force	Gravity	Relative	2.192	39	39
Story2	B373	L	Force	Gravity	Relative	2.192	39	39
Story2	B374	L	Force	Gravity	Relative	2.192	39	39
Story2	B375	L	Force	Gravity	Relative	2.192	39	39
Story2	B376	L	Force	Gravity	Relative	2.192	39	39
Story2	B377	L	Force	Gravity	Relative	2.192	39	39
Story2	B378	L	Force	Gravity	Relative	0.6	39	39
Story2	B347	DS	Force	Gravity	Relative	0.6	63	63

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Label	Load Pattern	Load Type	Direction	Distance Type	Absolute Distance B m	Force A kgf/m	Force B kgf/m
Story2	B348	DS	Force	Gravity	Relative	2.192	63	63
Story2	B349	DS	Force	Gravity	Relative	2.192	63	63
Story2	B350	DS	Force	Gravity	Relative	2.192	63	63
Story2	B351	DS	Force	Gravity	Relative	2.192	63	63
Story2	B352	DS	Force	Gravity	Relative	2.192	63	63
Story2	B353	DS	Force	Gravity	Relative	2.192	63	63
Story2	B354	DS	Force	Gravity	Relative	0.6	63	63
Story2	B355	DS	Force	Gravity	Relative	0.6	63	63
Story2	B356	DS	Force	Gravity	Relative	2.192	63	63
Story2	B357	DS	Force	Gravity	Relative	2.192	63	63
Story2	B358	DS	Force	Gravity	Relative	2.192	63	63
Story2	B359	DS	Force	Gravity	Relative	2.192	63	63
Story2	B360	DS	Force	Gravity	Relative	2.192	63	63
Story2	B361	DS	Force	Gravity	Relative	2.192	63	63
Story2	B362	DS	Force	Gravity	Relative	0.6	63	63
Story2	B363	DS	Force	Gravity	Relative	0.6	63	63
Story2	B364	DS	Force	Gravity	Relative	2.192	63	63
Story2	B365	DS	Force	Gravity	Relative	2.192	63	63
Story2	B366	DS	Force	Gravity	Relative	2.192	63	63
Story2	B367	DS	Force	Gravity	Relative	2.192	63	63
Story2	B368	DS	Force	Gravity	Relative	2.192	63	63
Story2	B369	DS	Force	Gravity	Relative	2.192	63	63
Story2	B370	DS	Force	Gravity	Relative	0.6	63	63
Story2	B371	DS	Force	Gravity	Relative	0.6	63	63
Story2	B372	DS	Force	Gravity	Relative	2.192	63	63
Story2	B373	DS	Force	Gravity	Relative	2.192	63	63
Story2	B374	DS	Force	Gravity	Relative	2.192	63	63
Story2	B375	DS	Force	Gravity	Relative	2.192	63	63
Story2	B376	DS	Force	Gravity	Relative	2.192	63	63
Story2	B377	DS	Force	Gravity	Relative	2.192	63	63
Story2	B378	DS	Force	Gravity	Relative	0.6	63	63
Story2	B347	W1	Force	Gravity	Relative	0.6	39	39
Story2	B348	W1	Force	Gravity	Relative	2.192	39	39
Story2	B349	W1	Force	Gravity	Relative	2.192	39	39

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Label	Load Pattern	Load Type	Direction	Distance Type	Absolute Distance B	Force A	Force B
						m	kgf/m	kgf/m
Story2	B350	W1	Force	Gravity	Relative	2.192	39	39
Story2	B351	W1	Force	Gravity	Relative	2.192	39	39
Story2	B352	W1	Force	Gravity	Relative	2.192	39	39
Story2	B353	W1	Force	Gravity	Relative	2.192	39	39
Story2	B354	W1	Force	Gravity	Relative	0.6	39	39
Story2	B355	W1	Force	Gravity	Relative	0.6	39	39
Story2	B356	W1	Force	Gravity	Relative	2.192	39	39
Story2	B357	W1	Force	Gravity	Relative	2.192	39	39
Story2	B358	W1	Force	Gravity	Relative	2.192	39	39
Story2	B359	W1	Force	Gravity	Relative	2.192	39	39
Story2	B360	W1	Force	Gravity	Relative	2.192	39	39
Story2	B361	W1	Force	Gravity	Relative	2.192	39	39
Story2	B362	W1	Force	Gravity	Relative	0.6	39	39
Story2	B363	W1	Force	Gravity	Relative	0.6	39	39
Story2	B364	W1	Force	Gravity	Relative	2.192	39	39
Story2	B365	W1	Force	Gravity	Relative	2.192	39	39
Story2	B366	W1	Force	Gravity	Relative	2.192	39	39
Story2	B367	W1	Force	Gravity	Relative	2.192	39	39
Story2	B368	W1	Force	Gravity	Relative	2.192	39	39
Story2	B369	W1	Force	Gravity	Relative	2.192	39	39
Story2	B370	W1	Force	Gravity	Relative	0.6	39	39
Story2	B371	W1	Force	Gravity	Relative	0.6	39	39
Story2	B372	W1	Force	Gravity	Relative	2.192	39	39
Story2	B373	W1	Force	Gravity	Relative	2.192	39	39
Story2	B374	W1	Force	Gravity	Relative	2.192	39	39
Story2	B375	W1	Force	Gravity	Relative	2.192	39	39
Story2	B376	W1	Force	Gravity	Relative	2.192	39	39
Story2	B377	W1	Force	Gravity	Relative	2.192	39	39
Story2	B378	W1	Force	Gravity	Relative	0.6	39	39
Story2	C14	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	C15	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	C17	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	C19	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	C20	W1	Force	Global-Y	Relative	0.8	150.26	150.26

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Label	Load Pattern	Load Type	Direction	Distance Type	Absolute Distance B	Force A	Force B
						m	kgf/m	kgf/m
Story2	C21	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	C22	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	C23	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	C24	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	C25	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	C26	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	C27	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	C28	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	C29	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	C30	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	C31	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	C33	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	C46	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	C47	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	C48	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	C49	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	C50	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	C51	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	C52	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	C53	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	C54	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	C55	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	C56	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	C57	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	C58	W1	Force	Global-Y	Relative	0.8	150.26	150.26
Story2	B347	W2	Force	Gravity	Relative	0.6	-44	-44
Story2	B348	W2	Force	Gravity	Relative	2.192	-44	-44
Story2	B349	W2	Force	Gravity	Relative	2.192	-44	-44
Story2	B350	W2	Force	Gravity	Relative	2.192	-44	-44
Story2	B351	W2	Force	Gravity	Relative	2.192	-44	-44
Story2	B352	W2	Force	Gravity	Relative	2.192	-44	-44
Story2	B353	W2	Force	Gravity	Relative	2.192	-44	-44
Story2	B354	W2	Force	Gravity	Relative	0.6	-44	-44
Story2	B355	W2	Force	Gravity	Relative	0.6	-44	-44

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Label	Load Pattern	Load Type	Direction	Distance Type	Absolute Distance B m	Force A kgf/m	Force B kgf/m
Story2	B356	W2	Force	Gravity	Relative	2.192	-44	-44
Story2	B357	W2	Force	Gravity	Relative	2.192	-44	-44
Story2	B358	W2	Force	Gravity	Relative	2.192	-44	-44
Story2	B359	W2	Force	Gravity	Relative	2.192	-44	-44
Story2	B360	W2	Force	Gravity	Relative	2.192	-44	-44
Story2	B361	W2	Force	Gravity	Relative	2.192	-44	-44
Story2	B362	W2	Force	Gravity	Relative	0.6	-44	-44
Story2	B363	W2	Force	Gravity	Relative	0.6	-44	-44
Story2	B364	W2	Force	Gravity	Relative	2.192	-44	-44
Story2	B365	W2	Force	Gravity	Relative	2.192	-44	-44
Story2	B366	W2	Force	Gravity	Relative	2.192	-44	-44
Story2	B367	W2	Force	Gravity	Relative	2.192	-44	-44
Story2	B368	W2	Force	Gravity	Relative	2.192	-44	-44
Story2	B369	W2	Force	Gravity	Relative	2.192	-44	-44
Story2	B370	W2	Force	Gravity	Relative	0.6	-44	-44
Story2	B371	W2	Force	Gravity	Relative	0.6	-44	-44
Story2	B372	W2	Force	Gravity	Relative	2.192	-44	-44
Story2	B373	W2	Force	Gravity	Relative	2.192	-44	-44
Story2	B374	W2	Force	Gravity	Relative	2.192	-44	-44
Story2	B375	W2	Force	Gravity	Relative	2.192	-44	-44
Story2	B376	W2	Force	Gravity	Relative	2.192	-44	-44
Story2	B377	W2	Force	Gravity	Relative	2.192	-44	-44
Story2	B378	W2	Force	Gravity	Relative	0.6	-44	-44
Story2	C14	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33
Story2	C15	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33
Story2	C17	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33
Story2	C19	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33
Story2	C20	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33
Story2	C21	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33
Story2	C22	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33
Story2	C23	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33
Story2	C24	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33
Story2	C25	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33
Story2	C26	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Label	Load Pattern	Load Type	Direction	Distance Type	Absolute Distance B	Force A	Force B
						m	kgf/m	kgf/m
Story2	C27	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33
Story2	C28	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33
Story2	C29	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33
Story2	C30	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33
Story2	C31	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33
Story2	C33	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33
Story2	C46	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33
Story2	C47	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33
Story2	C48	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33
Story2	C49	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33
Story2	C50	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33
Story2	C51	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33
Story2	C52	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33
Story2	C53	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33
Story2	C54	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33
Story2	C55	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33
Story2	C56	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33
Story2	C57	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33
Story2	C58	W2	Force	Global-Y	Relative	0.8	-114.33	-114.33

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

ANÁLISIS SÍSMICO

Del programa de análisis estructural se obtienen los valores de cortante basal en las direcciones X y Y, además del valor de masa participante en el sismo.

Output Case	Case Type	Step Type	FX	FY	FZ
			tonf	tonf	tonf
Dead	LinStatic		0	0	12.34
Live	LinStatic		0	0	2.24
SX	LinRespSpec	Max	6.8	0.32	0
SY	LinRespSpec	Max	0.32	4.15	0
SXEST	LinStatic		-6.95	0	0
SYEST	LinStatic		0	-6.95	0
DS	LinStatic		0	0	3.62
W1	LinStatic		0	-3.61	2.24
W2	LinStatic		0	2.74	-2.53

PESO DE LA ESTRUCTURA:	15.96 Ton	Sa:	0.5
Vs Estático:	7.98 Ton	Vs Dinámico:	7.18
CORTANTE SÍSMICO:	6.95 Ton	Factor de corrección:	1.15
CORTANTE DINÁMICO X:	6.80 Ton	Factor de corrección:	1.06
CORTANTE DINÁMICO Y:	4.15 Ton	Factor de corrección:	1.73

Verificación de fuerza sísmica en la base

Aplicados los factores de corrección obtenemos la fuerza sísmica corregida en la base.

Output Case	Case Type	Step Type	FX	FY
			tonf	tonf
SX	LinRespSpec	Max	7.21	0.34
SY	LinRespSpec	Max	0.55	7.19
SXEST	LinStatic		-7.99	0
SYEST	LinStatic		0	-7.99

Porcentaje de participación de masas

Número De Modos De Vibración: Deben incluirse en el análisis dinámico todos los modos de vibración que contribuyan de una manera significativa a la respuesta dinámica de la estructura. Se considera que se ha cumplido este requisito cuando se demuestra que, con el número de modos empleados, p, se ha

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

incluido en el cálculo de la respuesta, de cada una de las direcciones horizontales de análisis, j, por lo menos el 90% de la masa participante de la estructura. La masa participante, M_j , en cada una de las direcciones de análisis, j, para el número de modos empleados, p.

Para nuestro caso se alcanzó el 90% de aportes de masa en el modo 2 en X y en el modo 4 en Y.

Case	Mode	Period	UX	UY	UZ	SumUX	SumUY
		sec					
Modal	1	0.421	0.0016	0.397	0	0.0016	0.397
Modal	2	0.253	0.9794	0.0014	0	0.981	0.3984
Modal	3	0.153	0.0007	0.2405	0	0.9818	0.6389
Modal	4	0.111	2.93E-05	0.3256	0	0.9818	0.9645
Modal	5	0.11	0.0006	0.0265	0	0.9824	0.991

Verificación valor periodo de vibración	
H=	5.49 m
Ta=	0.281
Cu=	1.412
Cu*Ta=	0.397
T=	0.253
T<CuTa	CUMPLE

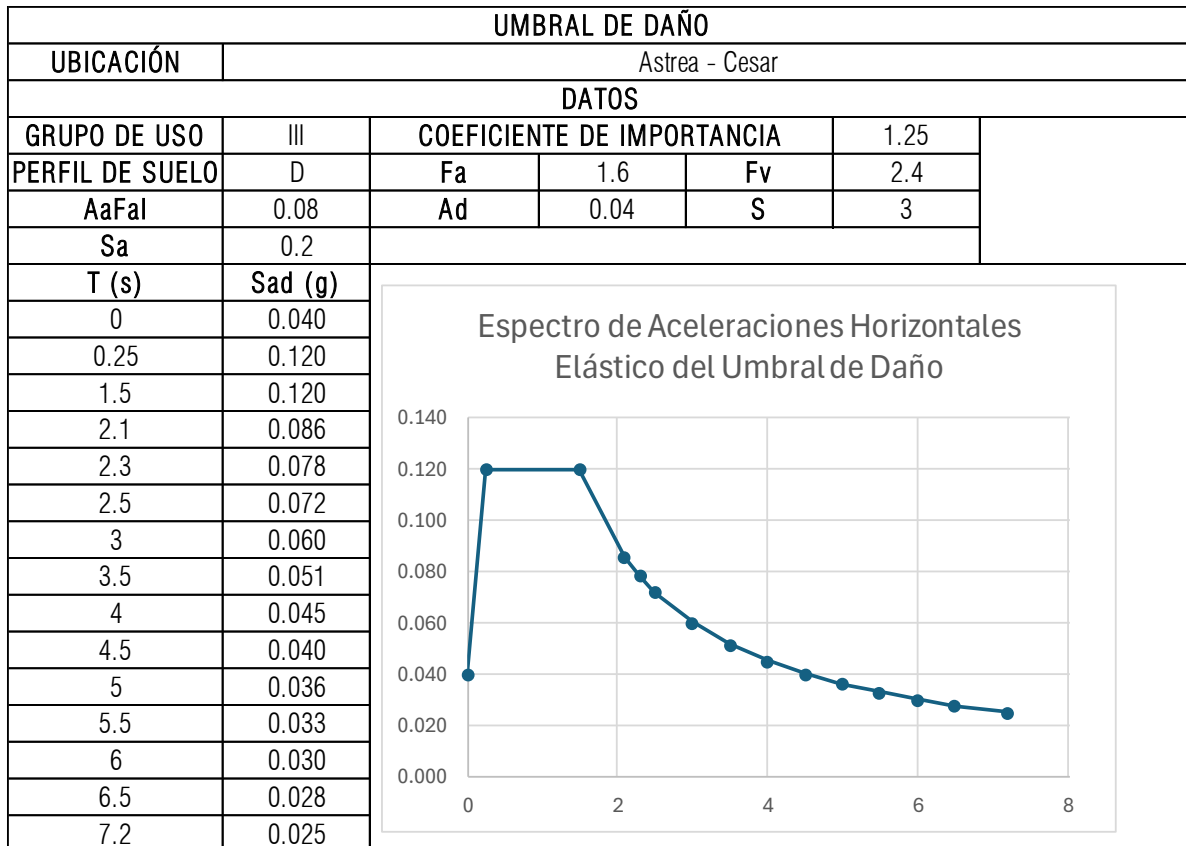
Se verifica el valor de S_a para el periodo de vibración más significativo en la tabla de participación de masa, donde se comprueba que la aceleración no cambia para el periodo significativo.

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

VERIFICACIÓN DE REQUISITOS ESPECIALES ACORDE AL CAPITULO A.12 NSR-10



Output Case	Case Type	Step Type	FX	FY	FZ
			tonf	tonf	tonf
Dead	LinStatic		0	0	12.34
Live	LinStatic		0	0	2.24
DS	LinStatic		0	0	3.62
W1	LinStatic		0	0	2.24
W2	LinStatic		0	0	-2.53
SX-UMBRAL	LinRespSpec	Max	1.63	0.08	0
SY-UMBRAL	LinRespSpec	Max	0.08	0.83	0
SX-UMBRAL1	LinStatic		-1.67	0	0
SY-UMBRAL1	LinStatic		0	-1.67	0

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

PESO DE LA ESTRUCTURA:	15.96 Ton	Sa:	0.12
Vs Estático:	1.92 Ton	Vs Dinámico:	1.72
CORTANTE SÍSMICO:	1.67 Ton	Factor de corrección:	1.15
CORTANTE DINÁMICO X:	1.63 Ton	Factor de corrección:	1.06
CORTANTE DINÁMICO Y:	0.83 Ton	Factor de corrección:	2.08

Aplicados los factores de corrección obtenemos:

Output Case	Case Type	Step Type	FX tonf	FY tonf
SX-UMBRAL	LinRespSpec	Max	1.73	0.08
SY-UMBRAL	LinRespSpec	Max	0.16	1.72
SX-UMBRAL-EST	LinStatic		-1.92	0
SY-UMBRAL-EST	LinStatic		0	-1.92

DERIVAS POR UMBRAL DE DAÑO

Story	Output Case	Case Type	Step Type	Direction	Drift	Verificación	
Story3	SY	LinRespSpec	Max	X	0.354%	<1.0%	OK
Story3	SY	LinRespSpec	Max	Y	0.031%	<1.0%	OK
Story3	SXEST	LinStatic		X	0.201%	<1.0%	OK
Story3	SYEST	LinStatic		X	0.234%	<1.0%	OK
Story3	SYEST	LinStatic		Y	0.026%	<1.0%	OK
Story3	SX-UMBRAL	LinRespSpec	Max	X	0.040%	<0.4%	OK
Story3	SY-UMBRAL	LinRespSpec	Max	X	0.102%	<0.4%	OK
Story3	SY-UMBRAL	LinRespSpec	Max	Y	0.009%	<0.4%	OK
Story3	SX-UMBRAL-EST	LinStatic		X	0.048%	<0.4%	OK
Story3	SY-UMBRAL-EST	LinStatic		X	0.056%	<0.4%	OK
Story3	SY-UMBRAL-EST	LinStatic		Y	0.006%	<0.4%	OK
Story2	SY	LinRespSpec	Max	X	0.081%	<1.0%	OK
Story2	SY	LinRespSpec	Max	Y	0.061%	<1.0%	OK
Story2	SXEST	LinStatic		X	0.196%	<1.0%	OK
Story2	SYEST	LinStatic		Y	0.065%	<1.0%	OK
Story2	SX-UMBRAL	LinRespSpec	Max	X	0.042%	<0.4%	OK
Story2	SY-UMBRAL	LinRespSpec	Max	X	0.023%	<0.4%	OK
Story2	SY-UMBRAL	LinRespSpec	Max	Y	0.013%	<0.4%	OK

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Output Case	Case Type	Step Type	Direction	Drift	Verificación	
Story2	SX-UMBRAL-EST	LinStatic		X	0.047%	<0.4%	OK
Story2	SY-UMBRAL-EST	LinStatic		Y	0.016%	<0.4%	OK

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

ANÁLISIS DE IRREGULARIDADES

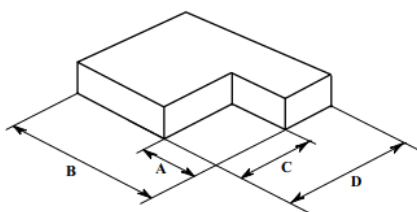
Irregularidades en planta

Tipo 1aP y 1bP

IRREGULARIDAD TORSIONAL - TIPO 1aP			IRREGULARIDAD TORSIONAL EXTREMA - TIPO 1bP		
$\phi_p=0.90$			$\phi_p=0.80$		
$1.4 \left(\frac{\Delta 1 + \Delta 2}{2} \right) \geq \Delta 1 > 1.2 \left(\frac{\Delta 1 + \Delta 2}{2} \right)$			$\Delta 1 > 1.4 \left(\frac{\Delta 1 + \Delta 2}{2} \right)$		
SISMO X			Tipo 1aP		
PISO 1	$\Delta 1$	10.44 mm	$1.4((\Delta 1 + \Delta 2)/2)$	14.18 mm	OK
	$\Delta 2$	9.81 mm	$1.2((\Delta 1 + \Delta 2)/2)$	12.15 mm	

IRREGULARIDAD TORSIONAL - TIPO 1aP			IRREGULARIDAD TORSIONAL EXTREMA - TIPO 1bP		
$\phi_p=0.90$			$\phi_p=0.80$		
$1.4 \left(\frac{\Delta 1 + \Delta 2}{2} \right) \geq \Delta 1 > 1.2 \left(\frac{\Delta 1 + \Delta 2}{2} \right)$			$\Delta 1 > 1.4 \left(\frac{\Delta 1 + \Delta 2}{2} \right)$		
SISMO Y			Tipo 1aP		
PISO 1	$\Delta 1$	35.07 mm	$1.4((\Delta 1 + \Delta 2)/2)$	26.67 mm	NO CUMPLE, OP=0.9
	$\Delta 2$	3.03 mm	$1.2((\Delta 1 + \Delta 2)/2)$	22.86 mm	

Tipo 2P

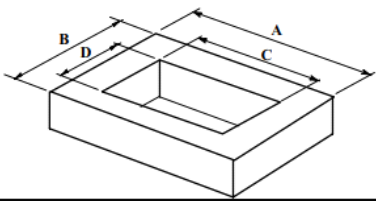
N O A P L I C A	RETROCESO EN LAS ESQUINAS - TIPO 2P		
	$\Phi p=0.90$		
			
	DATOS DE ENTRADA		
	A=	0 mm	STORY1
	B=	0 mm	
	C=	0 mm	
D=	0 mm		
A>0.15B		NO CUMPLE OP=1,0	
C>0.15D		NO CUMPLE OP=1,0	

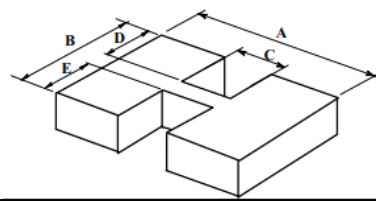
MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

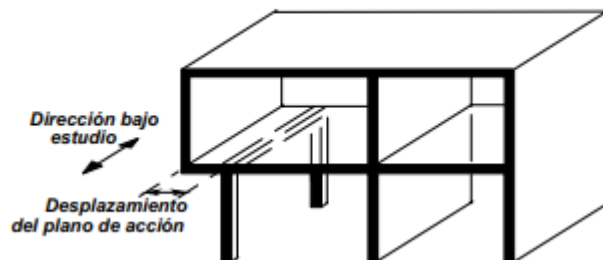
Tipo 3P

N O A P L I C A	IRREGULARIDAD DEL DIAFRAGMA - TIPO 3P			
	$\Phi_p=0.90$			
	1) $C \times D > 0.5 A \times B$			
				
	DATOS DE ENTRADA			
	A=	0	mm	STORY1
	B=	0	mm	
	C=	0	mm	
	D=	0	mm	
	C*D=	0	0.5A*B=	0
¡NO CUMPLE! OP=1.00				

N O A P L I C A	IRREGULARIDAD DEL DIAFRAGMA - TIPO 3P			
	$\Phi_p=0.90$			
	2) $(C \times D + C \times E) > 0.5 A \times B$			
				
	DATOS DE ENTRADA			
	A=	0	mm	STORY1
	B=	0	mm	
	C=	0	mm	
	D=	0	mm	
	E=	0	mm	
(C*D+C*E)=	0	0.5A*B=	0	

Tipo 4P

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



No aplica

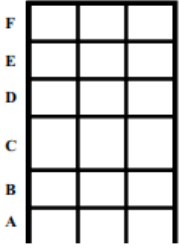
MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Irregularidades en altura

Tipo 1aA y 1bA

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

No aplica.

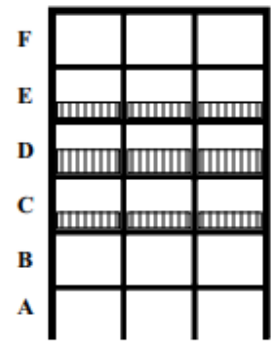
Tipo 2A

Tipo 2A — Distribución masa — $\phi_a = 0.9$

$$m_D > 1.50 m_E$$

o

$$m_D > 1.50 m_C$$

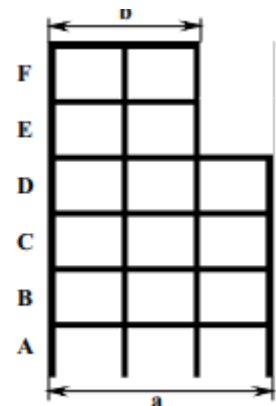


No aplica.

Tipo 3A

Tipo 3A — Geométrica — $\phi_a = 0.9$

$$a > 1.30 b$$

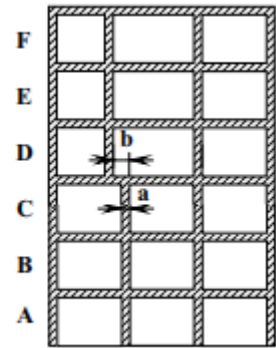


No Aplica

Tipo 4A

Tipo 4A — Desplazamiento dentro del plano de acción — $\phi_a = 0.8$

$$b > a$$



No aplica.

Tipo 5aA – Tipo 5bA

Tipo 5aA — Piso débil

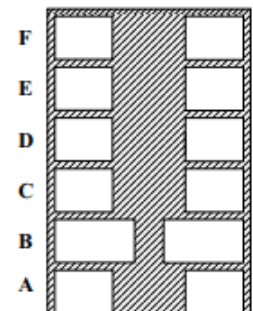
$$\phi_a = 0.9$$

$$0.65 \text{ Resist. Piso C} \leq \text{Resist. Piso B} < 0.80 \text{ Resist. Piso C}$$

Tipo 5bA — Piso débil extremo

$$\phi_a = 0.8$$

$$\text{Resistencia Piso B} < 0.65 \text{ Resistencia Piso C}$$



No aplica

Ausencia de redundancia

Acorde a lo mencionado en el artículo A.3.3.8 de la norma NSR-10, se evalúa que el factor de reducción por ausencia de redundancia será:

$$\phi_{rx} = 0.75$$

$$\phi_{ry} = 0.75$$

En conclusión, los factores de reducción de sismo quedan así:

$$\phi_a = 1.0$$

$$\phi_{px} = 1.0$$

$$\phi_{py} = 0.80$$

$$\phi_{rx} = 0.75$$

$$\phi_{ry} = 0.75$$

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

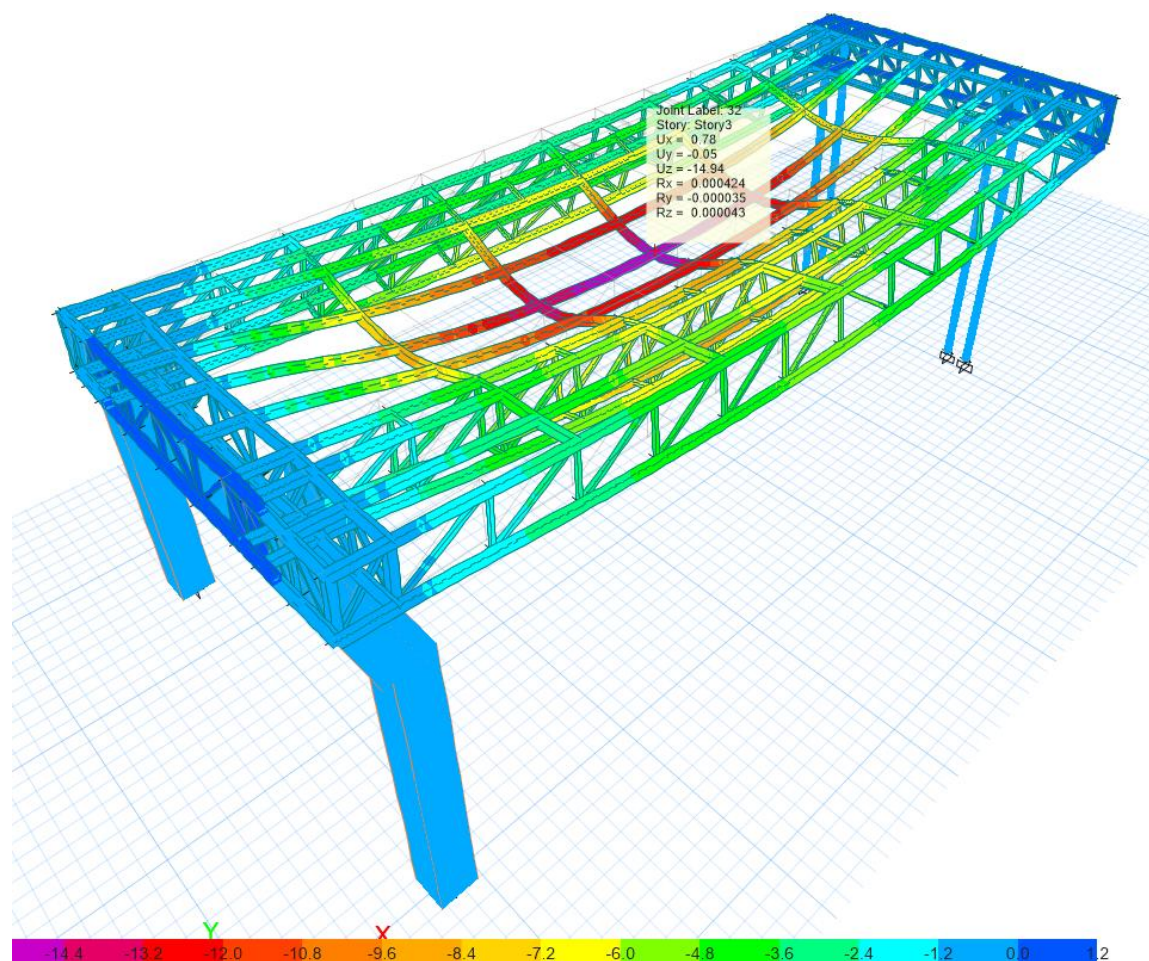
INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

VERIFICACIÓN DE DEFLEXIONES

TABLA C.9.5(b) — Deflexión máxima admisible calculada

Tipo de elemento	Deflexión considerada	Límite de deflexión
Cubiertas planas que no soporten ni estén ligadas a elementos no estructurales susceptibles de sufrir daños debido a deflexiones grandes.	Deflexión inmediata debida a la carga viva, L	$\ell/180^*$
Entrepisos que no soporten ni estén ligados a elementos no estructurales susceptibles de sufrir daños debido a deflexiones grandes.	Deflexión inmediata debida a la carga viva, L	$\ell/360$
Sistema de entrepiso o cubierta que soporte o esté ligado a elementos no estructurales susceptibles de sufrir daños debido a deflexiones grandes.	La parte de la deflexión total que ocurre después de la unión de los elementos no estructurales (la suma de la deflexión a largo plazo debida a todas las cargas permanentes, y la deflexión inmediata debida a cualquier carga viva adicional) [†]	$\ell/480^{\ddagger}$
Sistema de entrepiso o cubierta que soporte o esté ligado a elementos no estructurales no susceptibles de sufrir daños debido a deflexiones grandes.		$\ell/240^{\S}$

$$\frac{l}{180} = \frac{13150mm}{180} = 73.05mm$$



Deflexión máxima por carga viva más carga muerta: -14.94 mm

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

DISEÑO DE ELEMENTOS ESTRUCTURALES

Verificados los chequeos de deflexiones y análisis, procedemos a reducir el sismo de acuerdo con el capítulo A3 de la norma NSR-10.

Acorde a lo mencionado en la descripción de la estructura y análisis de irregularidades,

$$R_o = 1.50$$

$$\phi_a = 1.0$$

$$\phi_{px} = 1.0$$

$$\phi_{py} = 0.80$$

$$\phi_{rx} = 0.75$$

$$\phi_{ry} = 0.75$$

$$R_x = R_o * \phi_a * \phi_p * \phi_{rx} = 1.125$$

$$R_y = R_o * \phi_a * \phi_p * \phi_{ry} = 0.9 \cong 1.00$$

Aplicados los valores de reducción en el sismo procedemos a diseñar.

Diseño de elementos en concreto reforzado

Se aporta anexo donde se verifica el diseño estructural de los elementos tipo viga y pedestales.

Diseño de elementos metálicos en cubierta

Se aporta anexo donde se verifica el diseño estructural de los elementos tipo correa.

Diseño de elementos de cubierta

Story	Design Type	Design Section	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio	V Minor Ratio
Story3	Column	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.04	0.00	0.02	0.02	0.01	0.01
Story3	Column	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.04	0.00	0.02	0.02	0.01	0.01
Story3	Column	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.01	0.00	0.00	0.01		
Story3	Column	TUB100X100X3	(T)	0.06	0.01	0.03	0.02	0.01	0.01
Story3	Column	TUB100X100X3	(T)	0.06	0.00	0.02	0.03	0.01	0.02
Story3	Column	TUB50X50X2	(T)	0.13	0.03	0.04	0.07	0.01	0.03
Story3	Column	TUB50X50X2	(T)	0.20	0.02	0.02	0.16	0.00	0.04
Story3	Column	TUB50X50X2	(T)	0.16	0.02	0.01	0.13	0.00	0.04
Story3	Column	TUB50X50X2	(T)	0.25	0.01	0.01	0.23	0.00	0.05
Story3	Column	TUB50X50X2	(T)	0.16	0.00	0.00	0.15	0.00	0.04
Story3	Column	TUB50X50X2	(T)	0.24	0.00	0.00	0.24	0.00	0.05
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W2(C)	0.11	0.00	0.00	0.11	0.00	0.04
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W2(T)	0.16	0.01	0.01	0.15		

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Design Type	Design Section	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio	V Minor Ratio
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W2(C)	0.17	0.00	0.00	0.16	0.00	0.05
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W2(T)	0.25	0.01	0.01	0.23		
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W2(C)	0.10	0.00	0.00	0.09	0.00	0.04
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W2(T)	0.16	0.02	0.02	0.13		
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W2(C)	0.11	0.00	0.00	0.10	0.01	0.04
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W2(T)	0.20	0.02	0.02	0.16		
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W2(C)	0.06	0.00	0.00	0.06	0.01	0.03
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W2(T)	0.13	0.03	0.04	0.06		
Story3	Column	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.05	0.01	0.01	0.04	0.01	0.02
Story3	Column	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.09	0.01	0.03	0.05		
Story3	Column	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.01	0.00	0.00	0.01	0.01	0.01
Story3	Column	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.03	0.00	0.02	0.01		
Story3	Column	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.02	0.00	0.01	0.01	0.01	0.01
Story3	Column	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.04	0.00	0.03	0.01		
Story3	Column	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.03	0.00	0.01	0.02	0.01	0.02
Story3	Column	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.06	0.01	0.03	0.02		
Story3	Column	TUB50X50X2	(T)	0.11	0.00	0.00	0.11	0.00	0.04
Story3	Column	TUB50X50X2	(T)	0.12	0.00	0.01	0.11	0.00	0.03
Story3	Column	TUB50X50X2	(T)	0.11	0.00	0.00	0.11	0.00	0.04
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W2(C)	0.16	0.00	0.00	0.16	0.00	0.05
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W2(T)	0.20	0.01	0.01	0.19		
Story3	Column	TUB50X50X2	ELU 1.2D+1.6W2+1.0L(C)	0.12	0.00	0.00	0.11	0.00	0.04
Story3	Column	TUB50X50X2	ELU 1.2D+1.6W2+1.0L(T)	0.14	0.00	0.01	0.13		
Story3	Column	TUB50X50X2	(T)	0.20	0.00	0.00	0.19	0.00	0.05
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W1(C)	0.14	0.01	0.00	0.13	0.00	0.04
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W1(T)	0.12	0.01	0.00	0.11		
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W1(C)	0.20	0.00	0.00	0.19	0.00	0.05
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W1(T)	0.18	0.01	0.01	0.17		
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W1(C)	0.12	0.01	0.00	0.11	0.00	0.04
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W1(T)	0.11	0.01	0.01	0.10		
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W1(C)	0.12	0.01	0.00	0.11	0.00	0.04
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W1(T)	0.13	0.01	0.01	0.11		
Story3	Column	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.11	0.00	0.00	0.10	0.00	0.03
Story3	Column	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.09	0.01	0.02	0.06		

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Design Type	Design Section	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio	V Minor Ratio
Story3	Column	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.05	0.01	0.01	0.03	0.00	0.01
Story3	Column	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.05	0.01	0.03	0.01	0.01	0.00
Story3	Column	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.01	0.00	0.01	0.00		
Story3	Column	TUB50X50X2	(T)	0.16	0.03	0.07	0.07	0.01	0.01
Story3	Column	TUB50X50X2	(T)	0.16	0.02	0.03	0.11	0.01	0.01
Story3	Column	TUB50X50X2	(T)	0.12	0.02	0.03	0.07	0.01	0.01
Story3	Column	TUB50X50X2	(T)	0.18	0.01	0.02	0.15	0.00	0.02
Story3	Column	TUB50X50X2	(T)	0.09	0.01	0.01	0.08	0.00	0.01
Story3	Column	TUB50X50X2	(T)	0.16	0.00	0.00	0.16	0.00	0.02
Story3	Column	TUB50X50X2	(T)	0.10	0.01	0.01	0.08	0.00	0.01
Story3	Column	TUB50X50X2	(T)	0.19	0.01	0.02	0.16	0.00	0.02
Story3	Column	TUB50X50X2	(T)	0.12	0.03	0.03	0.07	0.01	0.01
Story3	Column	TUB50X50X2	(T)	0.17	0.03	0.03	0.11	0.01	0.01
Story3	Column	TUB50X50X2	(T)	0.12	0.03	0.06	0.03	0.01	0.00
Story3	Column	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.05	0.01	0.03	0.01	0.01	0.00
Story3	Column	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.02	0.00	0.01	0.01		
Story3	Column	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(C)	0.01	0.00	0.01	0.00	0.00	0.00
Story3	Column	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(T)	0.02	0.00	0.02	0.00		
Story3	Column	TUB50X50X2	(T)	0.20	0.04	0.07	0.08	0.01	0.02
Story3	Column	TUB50X50X2	(T)	0.24	0.04	0.05	0.16	0.01	0.02
Story3	Column	TUB50X50X2	(T)	0.15	0.04	0.03	0.08	0.01	0.01
Story3	Column	TUB50X50X2	(T)	0.22	0.02	0.03	0.17	0.01	0.02
Story3	Column	TUB50X50X2	(T)	0.11	0.02	0.01	0.08	0.00	0.01
Story3	Column	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.19	0.00	0.01	0.17	0.00	0.02
Story3	Column	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.03	0.00	0.00	0.02		
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W2(C)	0.01	0.00	0.00	0.01	0.00	0.01
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W2(T)	0.12	0.02	0.02	0.09		
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W2(C)	0.03	0.00	0.00	0.02	0.01	0.03
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W2(T)	0.23	0.02	0.03	0.18		
Story3	Column	TUB50X50X2	(T)	0.15	0.04	0.04	0.07	0.01	0.01
Story3	Column	TUB50X50X2	(T)	0.24	0.04	0.05	0.16	0.01	0.02
Story3	Column	TUB50X50X2	(T)	0.19	0.06	0.10	0.04	0.01	0.01
Story3	Column	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.06	0.01	0.02	0.03	0.01	0.01
Story3	Column	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.05	0.01	0.02	0.02		

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Design Type	Design Section	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio	V Minor Ratio
Story3	Column	TUB100X100X3	(T)	0.03	0.00	0.02	0.01	0.00	0.00
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W2(C)	0.04	0.00	0.00	0.04	0.01	0.02
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W2(T)	0.25	0.05	0.09	0.11		
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W2(C)	0.04	0.00	0.00	0.03	0.01	0.03
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W2(T)	0.27	0.04	0.06	0.17		
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W2(C)	0.01	0.01	0.00	0.01	0.01	0.01
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W2(T)	0.15	0.04	0.04	0.07		
Story3	Column	TUB50X50X2	ELU 1.2D+1.6W2+1.0L(C)	0.05	0.00	0.00	0.04	0.01	0.02
Story3	Column	TUB50X50X2	ELU 1.2D+1.6W2+1.0L(T)	0.20	0.02	0.03	0.15		
Story3	Column	TUB50X50X2	ELU 1.2D+1.6W2+1.0L(C)	0.03	0.00	0.00	0.03	0.00	0.01
Story3	Column	TUB50X50X2	ELU 1.2D+1.6W2+1.0L(T)	0.09	0.01	0.01	0.07		
Story3	Column	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.16	0.00	0.01	0.15	0.00	0.02
Story3	Column	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.03	0.00	0.00	0.02		
Story3	Column	TUB50X50X2	(T)	0.10	0.01	0.02	0.07	0.00	0.01
Story3	Column	TUB50X50X2	(T)	0.19	0.01	0.03	0.16	0.01	0.02
Story3	Column	TUB50X50X2	(T)	0.13	0.03	0.03	0.07	0.01	0.01
Story3	Column	TUB50X50X2	(T)	0.24	0.03	0.05	0.15	0.01	0.02
Story3	Column	TUB50X50X2	(T)	0.19	0.05	0.08	0.06	0.01	0.01
Story3	Column	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.05	0.01	0.01	0.04	0.00	0.01
Story3	Column	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.03	0.00	0.00	0.02		
Story3	Column	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.04	0.01	0.02	0.01	0.00	0.00
Story3	Column	TUB50X50X2	(T)	0.16	0.02	0.04	0.10	0.01	0.01
Story3	Column	TUB50X50X2	(T)	0.10	0.02	0.01	0.07	0.00	0.01
Story3	Column	TUB50X50X2	(T)	0.06	0.01	0.02	0.03	0.00	0.00
Story3	Column	TUB50X50X2	(T)	0.09	0.01	0.01	0.08	0.00	0.01
Story3	Column	TUB50X50X2	(T)	0.05	0.01	0.01	0.03	0.00	0.00
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W2(C)	0.07	0.00	0.00	0.07	0.00	0.01
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W2(T)	0.09	0.00	0.00	0.09		
Story3	Column	TUB50X50X2	(T)	0.04	0.00	0.00	0.04	0.00	0.00
Story3	Column	TUB50X50X2	(T)	0.10	0.01	0.01	0.09	0.00	0.01
Story3	Column	TUB50X50X2	(T)	0.06	0.01	0.02	0.03	0.00	0.00
Story3	Column	TUB50X50X2	(T)	0.09	0.02	0.01	0.05	0.00	0.01
Story3	Column	TUB50X50X2	(T)	0.10	0.02	0.03	0.05	0.01	0.01
Story3	Column	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.08	0.02	0.04	0.02	0.01	0.00

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Design Type	Design Section	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio	V Minor Ratio
Story3	Column	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.11	0.01	0.07	0.03	0.01	0.01
Story3	Column	TUB50X50X2	(T)	0.11	0.00	0.10	0.01	0.01	0.00
Story3	Column	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.15	0.02	0.09	0.04	0.01	0.01
Story3	Column	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.02	0.00	0.01	0.02		
Story3	Column	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.06	0.02	0.02	0.02	0.00	0.00
Story3	Column	TUB50X50X2	(T)	0.05	0.00	0.03	0.01	0.01	0.00
Story3	Column	TUB50X50X2	(T)	0.04	0.00	0.04	0.01	0.01	0.00
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W2(C)	0.01	0.00	0.01	0.01	0.01	0.00
Story3	Column	TUB50X50X2	ELU 0.9D+1.6W2(T)	0.05	0.00	0.04	0.01		
Story3	Column	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.10	0.04	0.02	0.04	0.01	0.01
Story3	Column	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.03	0.01	0.01	0.02		
Story3	Column	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.14	0.02	0.07	0.06	0.01	0.01
Story3	Column	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.12	0.00	0.10	0.02	0.01	0.01
Story3	Column	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.11	0.00	0.07	0.03		
Story3	Column	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.15	0.02	0.08	0.05	0.01	0.01
Story3	Column	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.04	0.00	0.00	0.04		
Story3	Column	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.06	0.02	0.02	0.02	0.00	0.00
Story3	Column	TUB50X50X2	(T)	0.05	0.00	0.03	0.01	0.01	0.00
Story3	Column	TUB50X50X2	(T)	0.05	0.00	0.04	0.01	0.01	0.00
Story3	Column	TUB50X50X2	ELU 1.2D+1.6W2+1.0L(C)	0.03	0.00	0.02	0.01	0.01	0.00
Story3	Column	TUB50X50X2	ELU 1.2D+1.6W2+1.0L(T)	0.06	0.01	0.04	0.01		
Story3	Column	TUBC 152.4X4MM	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.22	0.02	0.05	0.19	0.01	0.05
Story3	Column	TUBC 152.4X4MM	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.19	0.00	0.04	0.18		
Story3	Column	TUBC 152.4X4MM	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.20	0.01	0.06	0.19	0.02	0.05
Story3	Column	TUBC 152.4X4MM	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.13	0.00	0.01	0.13		
Story3	Column	TUBC 152.4X4MM	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.18	0.00	0.04	0.18	0.01	0.05
Story3	Column	TUBC 152.4X4MM	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.14	0.00	0.00	0.14		
Story3	Column	TUBC 152.4X4MM	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.21	0.02	0.04	0.19	0.01	0.05
Story3	Column	TUBC 152.4X4MM	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.13	0.01	0.01	0.13		
Story3	Column	TUBC 152.4X4MM	ELU 1.2D+1.0L-1.0SX-0.3SY(C)	0.24	0.00	0.23	0.02	0.07	0.07
Story3	Column	TUBC 152.4X4MM	ELU 1.2D+1.0L-1.0SX-0.3SY(T)	0.20	0.00	0.19	0.02		
Story3	Column	TUBC 152.4X4MM	(T)	0.15	0.00	0.14	0.03	0.03	0.02
Story3	Column	TUBC 152.4X4MM	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.49	0.04	0.42	0.17	0.18	0.07
Story3	Column	TUBC 152.4X4MM	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.20	0.01	0.18	0.02	0.04	0.01

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Design Type	Design Section	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio	V Minor Ratio
Story3	Column	TUBC 152.4X4MM	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.46	0.03	0.40	0.16	0.19	0.09
Story3	Column	TUBC 152.4X4MM	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.16	0.01	0.15	0.03	0.04	0.01
Story3	Column	TUBC 152.4X4MM	ELU 1.2D+1.0L-1.0SX-0.3SY(C)	0.21	0.00	0.20	0.03	0.05	0.09
Story3	Column	TUBC 152.4X4MM	ELU 1.2D+1.0L-1.0SX-0.3SY(T)	0.18	0.00	0.17	0.02		
Story3	Column	TUBC 152.4X4MM	ELU 1.2D+1.6W1+1.0L(C)	0.07	0.00	0.07	0.01	0.03	0.01
Story3	Column	TUBC 152.4X4MM	ELU 1.2D+1.6W1+1.0L(T)	0.13	0.00	0.12	0.02		
Story3	Column	TUBC 152.4X4MM	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.52	0.03	0.10	0.48	0.01	0.03
Story3	Column	TUBC 152.4X4MM	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.54	0.05	0.11	0.48	0.01	0.03
Story3	Column	TUBC 152.4X4MM	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.52	0.04	0.09	0.48	0.01	0.03
Story3	Column	TUBC 152.4X4MM	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.32	0.00	0.03	0.32		
Story3	Column	TUBC 152.4X4MM	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.51	0.02	0.08	0.48	0.01	0.03
Story3	Beam	TUB100X100X3	(T)	0.16	0.01	0.05	0.10	0.04	0.05
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(C)	0.08	0.01	0.03	0.05	0.04	0.06
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(T)	0.16	0.01	0.05	0.09		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.10	0.01	0.04	0.05	0.03	0.05
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.13	0.03	0.05	0.05		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(C)	0.07	0.01	0.01	0.04	0.02	0.06
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(T)	0.13	0.02	0.04	0.08		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(C)	0.08	0.00	0.04	0.05	0.02	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(T)	0.14	0.00	0.06	0.07		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(C)	0.06	0.01	0.00	0.06	0.00	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(T)	0.11	0.02	0.01	0.09		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.14	0.01	0.01	0.12	0.01	0.05
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.05	0.01	0.01	0.04		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.13	0.00	0.04	0.08	0.01	0.05
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.14	0.00	0.04	0.11		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(C)	0.03	0.00	0.01	0.02	0.01	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(T)	0.08	0.01	0.04	0.03		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W1(C)	0.04	0.00	0.00	0.03	0.01	0.02
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W1(T)	0.08	0.01	0.05	0.02		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.04	0.00	0.00	0.04	0.01	0.04
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.11	0.00	0.01	0.10		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.10	0.01	0.00	0.09	0.01	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.13	0.02	0.02	0.08		

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Design Type	Design Section	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio	V Minor Ratio
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.12	0.01	0.02	0.08	0.02	0.04
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.07	0.00	0.03	0.04		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.09	0.00	0.01	0.08	0.01	0.04
Story3	Beam	TUB100X100X3	(T)	0.06	0.01	0.03	0.03	0.01	0.01
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.02	0.00	0.01	0.01	0.01	0.01
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.07	0.01	0.04	0.03		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.11	0.01	0.02	0.09	0.01	0.06
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.05	0.00	0.01	0.04		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.14	0.01	0.00	0.13	0.01	0.05
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.08	0.01	0.00	0.07		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.08	0.01	0.01	0.06	0.01	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.07	0.00	0.01	0.05	0.02	0.04
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.05	0.00	0.03	0.03		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(C)	0.05	0.00	0.00	0.05	0.02	0.06
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(T)	0.10	0.00	0.00	0.09		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(C)	0.04	0.01	0.01	0.03	0.02	0.04
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(T)	0.08	0.01	0.01	0.07		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.06	0.00	0.00	0.06	0.00	0.03
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.10	0.00	0.00	0.09		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W1(C)	0.03	0.00	0.00	0.02	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W1(T)	0.07	0.00	0.01	0.06		
Story3	Beam	TUB100X100X3	(T)	0.09	0.01	0.02	0.06	0.01	0.02
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.11	0.00	0.00	0.11	0.01	0.04
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.17	0.01	0.01	0.15		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.15	0.01	0.01	0.13	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.14	0.01	0.01	0.12	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.15	0.03	0.01	0.11	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.09	0.01	0.00	0.09		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.15	0.03	0.01	0.11	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.05	0.01	0.00	0.04		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.15	0.06	0.02	0.07	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.07	0.01	0.00	0.06		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.13	0.05	0.01	0.07	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.04	0.01	0.00	0.03		

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Design Type	Design Section	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio	V Minor Ratio
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.12	0.06	0.02	0.04	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.04	0.01	0.00	0.03		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.12	0.06	0.01	0.05	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.04	0.01	0.00	0.04		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.11	0.04	0.01	0.07	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.04	0.01	0.00	0.03		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.10	0.03	0.01	0.06	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.05	0.00	0.01	0.05		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.12	0.02	0.01	0.09	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.03	0.00	0.00	0.03		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.11	0.01	0.01	0.09	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.06	0.00	0.00	0.06		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.14	0.01	0.00	0.12	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.17	0.02	0.02	0.13		
Story3	Beam	TUB100X100X3	(T)	0.06	0.03	0.01	0.02	0.00	0.00
Story3	Beam	TUB100X100X3	(T)	0.08	0.04	0.01	0.03	0.00	0.00
Story3	Beam	TUB100X100X3	(T)	0.08	0.05	0.02	0.02	0.00	0.00
Story3	Beam	TUB100X100X3	(T)	0.09	0.05	0.01	0.03	0.00	0.00
Story3	Beam	TUB100X100X3	(T)	0.08	0.05	0.02	0.02	0.00	0.00
Story3	Beam	TUB100X100X3	(T)	0.08	0.05	0.02	0.02	0.00	0.00
Story3	Beam	TUB100X100X3	(T)	0.09	0.05	0.01	0.03	0.00	0.00
Story3	Beam	TUB100X100X3	(T)	0.08	0.04	0.02	0.02	0.00	0.00
Story3	Beam	TUB100X100X3	(T)	0.08	0.04	0.01	0.03	0.00	0.00
Story3	Beam	TUB100X100X3	(T)	0.06	0.03	0.01	0.03	0.00	0.00
Story3	Beam	TUB100X100X3	(T)	0.14	0.01	0.03	0.10	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W1(C)	0.13	0.00	0.02	0.11	0.01	0.05
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W1(T)	0.17	0.02	0.01	0.15		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(C)	0.05	0.00	0.01	0.03	0.01	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(T)	0.10	0.01	0.02	0.06		
Story3	Beam	TUB100X100X3	ELU 0.9D-1.0SY-0.3SX(C)	0.56	0.45	0.02	0.08	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 0.9D-1.0SY-0.3SX(T)	0.23	0.01	0.00	0.22		
Story3	Beam	TUB100X100X3	ELU 0.9D-1.0SY-0.3SX(C)	0.29	0.26	0.00	0.02	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 0.9D-1.0SY-0.3SX(T)	0.07	0.03	0.00	0.03		
Story3	Beam	TUB100X100X3	ELU 0.9D-1.0SY-0.3SX(C)	0.07	0.05	0.00	0.02	0.00	0.00

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Design Type	Design Section	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio	V Minor Ratio
Story3	Beam	TUB100X100X3	ELU 0.9D-1.0SY-0.3SX(T)	0.06	0.01	0.00	0.05		
Story3	Beam	TUB100X100X3	(T)	0.06	0.03	0.01	0.03	0.00	0.00
Story3	Beam	TUB100X100X3	(T)	0.06	0.02	0.00	0.04	0.00	0.00
Story3	Beam	TUB100X100X3	(T)	0.06	0.03	0.01	0.03	0.00	0.00
Story3	Beam	TUB100X100X3	(T)	0.06	0.03	0.01	0.03	0.00	0.00
Story3	Beam	TUB100X100X3	(T)	0.06	0.02	0.00	0.04	0.00	0.00
Story3	Beam	TUB100X100X3	(T)	0.06	0.02	0.00	0.04	0.00	0.00
Story3	Beam	TUB100X100X3	(T)	0.08	0.03	0.00	0.05	0.00	0.00
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.06	0.03	0.00	0.02	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.07	0.03	0.00	0.04		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.39	0.28	0.02	0.09	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.23	0.03	0.02	0.18		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.16	0.01	0.14	0.01	0.04	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SX-0.3SY(C)	0.07	0.00	0.05	0.01	0.01	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SX-0.3SY(T)	0.04	0.00	0.04	0.01		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(C)	0.23	0.02	0.09	0.12	0.02	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(T)	0.38	0.05	0.15	0.17		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(C)	0.07	0.01	0.01	0.05	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(T)	0.17	0.06	0.02	0.08		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.04	0.01	0.00	0.03	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.14	0.06	0.01	0.07		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.03	0.00	0.00	0.03	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.14	0.07	0.02	0.06		
Story3	Beam	TUB100X100X3	(T)	0.13	0.07	0.01	0.05	0.00	0.01
Story3	Beam	TUB100X100X3	(T)	0.12	0.06	0.02	0.04	0.00	0.00
Story3	Beam	TUB100X100X3	(T)	0.11	0.06	0.02	0.03	0.00	0.00
Story3	Beam	TUB100X100X3	(T)	0.10	0.07	0.02	0.02	0.00	0.00
Story3	Beam	TUB100X100X3	(T)	0.11	0.05	0.02	0.04	0.00	0.01
Story3	Beam	TUB100X100X3	(T)	0.10	0.04	0.01	0.05	0.00	0.01
Story3	Beam	TUB100X100X3	(T)	0.09	0.03	0.01	0.05	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.04	0.00	0.00	0.04	0.01	0.01
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.19	0.01	0.07	0.11		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SX-0.3SY(C)	0.16	0.00	0.13	0.03	0.04	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SX-0.3SY(T)	0.05	0.00	0.02	0.03		

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Design Type	Design Section	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio	V Minor Ratio
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.12	0.01	0.06	0.06	0.02	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(C)	0.18	0.00	0.06	0.13	0.02	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(T)	0.33	0.02	0.12	0.19		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.05	0.01	0.00	0.04	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.13	0.04	0.01	0.08		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.04	0.01	0.00	0.03	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.13	0.06	0.01	0.06		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.04	0.00	0.00	0.03	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.15	0.07	0.02	0.06		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.03	0.00	0.00	0.02	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.13	0.07	0.01	0.04		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.02	0.00	0.00	0.02	0.00	0.00
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.14	0.09	0.03	0.02		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.02	0.00	0.00	0.01	0.00	0.00
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.13	0.09	0.03	0.00		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.02	0.00	0.00	0.01	0.00	0.00
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.12	0.09	0.02	0.01		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.02	0.00	0.00	0.01	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.13	0.07	0.02	0.04		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.02	0.00	0.00	0.02	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.11	0.05	0.02	0.04		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.02	0.00	0.00	0.02	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.10	0.04	0.02	0.05		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.03	0.00	0.00	0.02	0.02	0.01
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.20	0.02	0.09	0.09		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SX-0.3SY(C)	0.15	0.00	0.11	0.03	0.03	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SX-0.3SY(T)	0.04	0.00	0.01	0.03		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.13	0.01	0.06	0.07	0.02	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.07	0.00	0.03	0.03		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.36	0.00	0.12	0.24	0.02	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.32	0.02	0.10	0.20		
Story3	Beam	TUB100X100X3	(T)	0.13	0.02	0.02	0.09	0.00	0.02
Story3	Beam	TUB100X100X3	(T)	0.13	0.03	0.01	0.09	0.00	0.01
Story3	Beam	TUB100X100X3	(T)	0.14	0.04	0.03	0.08	0.00	0.01

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Design Type	Design Section	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio	V Minor Ratio
Story3	Beam	TUB100X100X3	(T)	0.12	0.06	0.01	0.05	0.00	0.01
Story3	Beam	TUB100X100X3	(T)	0.12	0.06	0.02	0.04	0.00	0.00
Story3	Beam	TUB100X100X3	(T)	0.11	0.06	0.02	0.03	0.00	0.00
Story3	Beam	TUB100X100X3	(T)	0.10	0.06	0.01	0.03	0.00	0.01
Story3	Beam	TUB100X100X3	(T)	0.12	0.04	0.03	0.06	0.00	0.01
Story3	Beam	TUB100X100X3	(T)	0.11	0.04	0.01	0.05	0.00	0.01
Story3	Beam	TUB100X100X3	(T)	0.11	0.02	0.02	0.07	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W1(C)	0.16	0.00	0.05	0.10	0.01	0.02
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W1(T)	0.21	0.00	0.08	0.13		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.19	0.01	0.13	0.04	0.03	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.11	0.00	0.10	0.01		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.10	0.00	0.05	0.05	0.02	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.04	0.00	0.02	0.01		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.35	0.02	0.10	0.23	0.02	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.34	0.04	0.11	0.19		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.13	0.00	0.02	0.11	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.15	0.04	0.02	0.09		
Story3	Beam	TUB100X100X3	(T)	0.13	0.04	0.01	0.07	0.00	0.01
Story3	Beam	TUB100X100X3	(T)	0.12	0.05	0.01	0.07	0.00	0.01
Story3	Beam	TUB100X100X3	(T)	0.11	0.05	0.01	0.05	0.00	0.01
Story3	Beam	TUB100X100X3	(T)	0.10	0.04	0.01	0.04	0.00	0.01
Story3	Beam	TUB100X100X3	(T)	0.08	0.04	0.01	0.03	0.00	0.00
Story3	Beam	TUB100X100X3	(T)	0.09	0.04	0.01	0.03	0.00	0.01
Story3	Beam	TUB100X100X3	(T)	0.10	0.04	0.01	0.06	0.00	0.01
Story3	Beam	TUB100X100X3	(T)	0.10	0.03	0.01	0.06	0.00	0.01
Story3	Beam	TUB100X100X3	(T)	0.09	0.02	0.00	0.07	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W1(C)	0.14	0.00	0.02	0.13	0.01	0.02
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W1(T)	0.19	0.00	0.03	0.16		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.14	0.01	0.09	0.05	0.08	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.17	0.00	0.10	0.06	0.09	0.05
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.14	0.00	0.09	0.05		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.16	0.01	0.01	0.15	0.02	0.10
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.15	0.01	0.01	0.13		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.09	0.01	0.01	0.07	0.00	0.03

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Design Type	Design Section	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio	V Minor Ratio
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.05	0.01	0.01	0.04		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.14	0.01	0.02	0.11	0.01	0.04
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.15	0.02	0.02	0.11		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.11	0.01	0.01	0.09	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.04	0.01	0.00	0.03		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.14	0.01	0.03	0.10	0.01	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.03	0.01	0.01	0.02		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.24	0.02	0.03	0.19	0.01	0.06
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.15	0.00	0.01	0.13		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.22	0.02	0.03	0.17	0.01	0.05
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.13	0.00	0.01	0.13		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.23	0.02	0.03	0.18	0.01	0.05
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.22	0.02	0.02	0.18	0.01	0.06
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.19	0.00	0.02	0.17		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.18	0.04	0.06	0.09	0.01	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.06	0.00	0.02	0.04		
Story3	Beam	TUB100X100X3	ELU 0.9D-1.0SY-0.3SX(C)	0.04	0.00	0.01	0.04	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 0.9D-1.0SY-0.3SX(T)	0.06	0.01	0.01	0.04		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(C)	0.03	0.00	0.00	0.03	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(T)	0.05	0.00	0.01	0.04		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.20	0.03	0.07	0.09	0.02	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.09	0.01	0.03	0.05		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.08	0.01	0.01	0.06	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.07	0.01	0.01	0.06	0.01	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.07	0.01	0.01	0.06		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W1(C)	0.05	0.00	0.00	0.04	0.01	0.08
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W1(T)	0.15	0.01	0.02	0.13		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.11	0.01	0.02	0.09	0.01	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.09	0.00	0.02	0.07		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.12	0.01	0.02	0.09	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.10	0.01	0.01	0.08	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.05	0.01	0.01	0.04	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.02	0.00	0.00	0.02		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.05	0.01	0.00	0.04	0.00	0.01

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Design Type	Design Section	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio	V Minor Ratio
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.03	0.00	0.00	0.02		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.08	0.00	0.00	0.08	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.11	0.01	0.02	0.08		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.30	0.02	0.21	0.06	0.20	0.04
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.22	0.00	0.18	0.04		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.32	0.01	0.20	0.11	0.20	0.08
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.31	0.02	0.22	0.08		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.25	0.00	0.18	0.07	0.08	0.12
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.27	0.00	0.17	0.10		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.12	0.00	0.02	0.10	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.10	0.00	0.00	0.09		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.27	0.01	0.17	0.09	0.04	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.17	0.00	0.10	0.07		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.31	0.05	0.21	0.05	0.04	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.20	0.02	0.14	0.04		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.03	0.00	0.02	0.01	0.00	0.00
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.07	0.01	0.04	0.02		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.03	0.00	0.02	0.01	0.00	0.00
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.07	0.02	0.03	0.02		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.30	0.04	0.20	0.06	0.04	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.16	0.02	0.11	0.03		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.08	0.01	0.02	0.05	0.01	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.08	0.00	0.01	0.06	0.01	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.07	0.01	0.02	0.05		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.10	0.00	0.02	0.07	0.01	0.04
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.07	0.00	0.02	0.05		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.08	0.00	0.02	0.06	0.01	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.09	0.01	0.02	0.06	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.10	0.02	0.03	0.05	0.01	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.06	0.00	0.02	0.04		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.04	0.01	0.01	0.02	0.00	0.00
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.01	0.00	0.00	0.01		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.03	0.01	0.00	0.02	0.00	0.00
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.01	0.00	0.00	0.01		

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Design Type	Design Section	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio	V Minor Ratio
Story3	Beam	TUB100X100X3	ELU 0.9D-1.0SY-0.3SX(C)	0.09	0.01	0.03	0.05	0.01	0.01
Story3	Beam	TUB100X100X3	ELU 0.9D-1.0SY-0.3SX(T)	0.10	0.01	0.04	0.05		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.20	0.02	0.03	0.16	0.01	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.13	0.01	0.00	0.12		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.19	0.03	0.01	0.15	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.13	0.01	0.01	0.11		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.16	0.02	0.00	0.14	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.18	0.03	0.01	0.13	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.12	0.03	0.01	0.09	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.14	0.03	0.01	0.09	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.10	0.03	0.01	0.06	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.10	0.03	0.01	0.07	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.11	0.03	0.01	0.07	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.10	0.02	0.00	0.08	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.12	0.02	0.01	0.09	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.11	0.01	0.01	0.09	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.04	0.00	0.00	0.03		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.19	0.00	0.03	0.15	0.01	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.21	0.01	0.03	0.16		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.19	0.02	0.02	0.15	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.11	0.01	0.00	0.10		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.17	0.02	0.01	0.14	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.19	0.04	0.02	0.14	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.14	0.04	0.01	0.09	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.15	0.05	0.02	0.09	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.12	0.04	0.02	0.05	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.12	0.04	0.01	0.07	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.14	0.03	0.02	0.09	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.12	0.02	0.00	0.09	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.14	0.01	0.02	0.12	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.06	0.00	0.01	0.05	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.13	0.01	0.02	0.10		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.15	0.01	0.03	0.11	0.01	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.03	0.00	0.01	0.02		

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Design Type	Design Section	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio	V Minor Ratio
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.11	0.02	0.04	0.06	0.01	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.05	0.01	0.01	0.03		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.12	0.02	0.04	0.06	0.01	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.07	0.00	0.02	0.04		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.13	0.02	0.02	0.09	0.01	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.03	0.00	0.00	0.03		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(C)	0.14	0.01	0.01	0.13	0.01	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(T)	0.23	0.03	0.03	0.18		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.21	0.01	0.01	0.19	0.00	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.20	0.00	0.00	0.19		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.22	0.03	0.02	0.17	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.23	0.04	0.03	0.16	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.20	0.05	0.02	0.13	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.21	0.05	0.02	0.14	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.09	0.00	0.00	0.08		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.17	0.05	0.03	0.09	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.04	0.00	0.00	0.04		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.18	0.05	0.02	0.11	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.05	0.00	0.00	0.05		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.14	0.04	0.02	0.08	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.01	0.00	0.00	0.00		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.14	0.03	0.02	0.09	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.02	0.00	0.00	0.01		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.09	0.01	0.01	0.07	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.02	0.00	0.00	0.02		
Story3	Beam	TUB100X100X3	(T)	0.12	0.02	0.03	0.07	0.01	0.01
Story3	Beam	TUB100X100X3	(T)	0.24	0.03	0.03	0.18	0.01	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.22	0.01	0.01	0.20	0.00	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.15	0.00	0.00	0.15		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.23	0.04	0.02	0.17	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.12	0.00	0.00	0.11		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.24	0.04	0.02	0.18	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.21	0.05	0.03	0.14	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.22	0.06	0.03	0.13	0.00	0.02

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Design Type	Design Section	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio	V Minor Ratio
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.18	0.06	0.03	0.09	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.19	0.06	0.02	0.11	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.15	0.04	0.02	0.08	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.14	0.03	0.02	0.09	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.10	0.01	0.01	0.08	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.02	0.00	0.01	0.01		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.04	0.00	0.00	0.04	0.01	0.01
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.13	0.02	0.03	0.08		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(C)	0.10	0.01	0.00	0.09	0.00	0.04
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(T)	0.16	0.01	0.01	0.14		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.06	0.00	0.00	0.06	0.00	0.03
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.11	0.01	0.00	0.09		
Story3	Beam	TUB100X100X3	(T)	0.10	0.01	0.01	0.09	0.00	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.15	0.01	0.01	0.13	0.00	0.04
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.15	0.01	0.01	0.13		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.12	0.01	0.01	0.11	0.00	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.14	0.02	0.01	0.11		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W1(C)	0.06	0.00	0.00	0.06	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W1(T)	0.09	0.02	0.00	0.07		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.04	0.00	0.00	0.03	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.07	0.01	0.00	0.06		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(C)	0.06	0.00	0.01	0.05	0.01	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(T)	0.12	0.01	0.02	0.09		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(C)	0.04	0.00	0.01	0.03	0.00	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(T)	0.08	0.00	0.00	0.07		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(C)	0.05	0.00	0.01	0.04	0.01	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(T)	0.11	0.01	0.02	0.07		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W1(C)	0.03	0.00	0.00	0.02	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W1(T)	0.08	0.00	0.01	0.06		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.12	0.01	0.00	0.11	0.01	0.04
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.15	0.01	0.02	0.11		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.13	0.00	0.02	0.11	0.01	0.04
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.07	0.00	0.00	0.07		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(C)	0.07	0.00	0.02	0.05	0.02	0.06

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Design Type	Design Section	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio	V Minor Ratio
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W2(T)	0.19	0.01	0.05	0.13		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.15	0.01	0.01	0.14	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.11	0.00	0.01	0.10		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.14	0.02	0.01	0.12	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.07	0.00	0.01	0.06		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.16	0.03	0.01	0.11	0.00	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.11	0.00	0.01	0.10		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.15	0.03	0.00	0.11	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.13	0.05	0.01	0.07	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.08	0.01	0.00	0.07		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.13	0.05	0.01	0.08	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.05	0.01	0.00	0.05		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.11	0.05	0.01	0.05	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.05	0.01	0.00	0.04		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.11	0.05	0.01	0.05	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.05	0.01	0.00	0.05		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.11	0.04	0.00	0.07	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.05	0.00	0.00	0.04		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.11	0.04	0.01	0.07	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.05	0.00	0.01	0.03		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.10	0.02	0.00	0.08	0.00	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.10	0.02	0.00	0.08	0.00	0.01
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.54	0.00	0.09	0.45	0.02	0.16
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.51	0.00	0.07	0.44		
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.56	0.00	0.08	0.48	0.02	0.17
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.37	0.00	0.03	0.33		
Story3	Beam	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.42	0.01	0.19	0.23	0.02	0.08
Story3	Beam	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.19	0.00	0.04	0.14		
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.37	0.01	0.12	0.25	0.02	0.09
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.22	0.00	0.15	0.06		
Story3	Beam	TUB50X50X2	(T)	0.55	0.00	0.09	0.46	0.00	0.16
Story3	Beam	TUB50X50X2	(T)	0.57	0.00	0.07	0.49	0.00	0.18
Story3	Beam	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.38	0.01	0.21	0.16	0.02	0.06
Story3	Beam	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.38	0.00	0.22	0.16		

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Design Type	Design Section	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio	V Minor Ratio
Story3	Beam	TUB50X50X2	ELU 1.2D+1.6W2+1.0L(C)	0.27	0.01	0.13	0.13	0.04	0.07
Story3	Beam	TUB50X50X2	ELU 1.2D+1.6W2+1.0L(T)	0.36	0.01	0.17	0.19		
Story3	Beam	TUB50X50X2	(T)	0.43	0.00	0.11	0.32	0.01	0.11
Story3	Beam	TUB50X50X2	ELU 0.9D+1.6W2(C)	0.23	0.00	0.05	0.18	0.01	0.13
Story3	Beam	TUB50X50X2	ELU 0.9D+1.6W2(T)	0.43	0.00	0.08	0.36		
Story3	Beam	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.31	0.01	0.24	0.07	0.02	0.03
Story3	Beam	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.30	0.00	0.23	0.07		
Story3	Beam	TUB50X50X2	ELU 1.2D+1.6W2+1.0L(C)	0.22	0.01	0.16	0.06	0.05	0.04
Story3	Beam	TUB50X50X2	ELU 1.2D+1.6W2+1.0L(T)	0.27	0.01	0.18	0.08		
Story3	Beam	TUB50X50X2	(T)	0.32	0.00	0.11	0.21	0.01	0.08
Story3	Beam	TUB50X50X2	ELU 0.9D+1.6W2(C)	0.12	0.00	0.05	0.07	0.01	0.08
Story3	Beam	TUB50X50X2	ELU 0.9D+1.6W2(T)	0.32	0.00	0.07	0.24		
Story3	Beam	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.29	0.01	0.19	0.09	0.02	0.04
Story3	Beam	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.34	0.00	0.23	0.11		
Story3	Beam	TUB50X50X2	ELU 1.2D+1.6W2+1.0L(C)	0.16	0.01	0.14	0.01	0.04	0.04
Story3	Beam	TUB50X50X2	ELU 1.2D+1.6W2+1.0L(T)	0.31	0.01	0.18	0.13		
Story3	Beam	TUB50X50X2	(T)	0.31	0.00	0.09	0.22	0.01	0.08
Story3	Beam	TUB50X50X2	ELU 0.9D+1.6W2(C)	0.07	0.00	0.03	0.04	0.01	0.09
Story3	Beam	TUB50X50X2	ELU 0.9D+1.6W2(T)	0.30	0.00	0.06	0.24		
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.35	0.00	0.19	0.16	0.02	0.05
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.13	0.00	0.09	0.04		
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.33	0.01	0.15	0.17	0.03	0.06
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.21	0.01	0.18	0.03		
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.29	0.00	0.04	0.25	0.01	0.09
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.14	0.00	0.01	0.13		
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.29	0.00	0.03	0.25	0.01	0.09
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.11	0.00	0.02	0.09		
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.67	0.00	0.11	0.56	0.03	0.18
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.36	0.00	0.06	0.30		
Story3	Beam	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.89	0.00	0.12	0.77	0.04	0.24
Story3	Beam	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.77	0.00	0.11	0.66		
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.68	0.00	0.10	0.58	0.03	0.18
Story3	Beam	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.91	0.00	0.13	0.77	0.04	0.24
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.58	0.00	0.09	0.49	0.02	0.15

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Design Type	Design Section	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio	V Minor Ratio
Story3	Beam	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.75	0.00	0.11	0.64	0.03	0.20
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.46	0.00	0.09	0.37	0.02	0.12
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.21	0.00	0.02	0.19		
Story3	Beam	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.58	0.00	0.13	0.45	0.04	0.14
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.35	0.00	0.08	0.27	0.02	0.08
Story3	Beam	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.39	0.00	0.10	0.29	0.03	0.09
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.25	0.00	0.08	0.16	0.02	0.05
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.09	0.00	0.01	0.08		
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.27	0.00	0.09	0.18	0.03	0.06
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.24	0.00	0.07	0.17	0.01	0.05
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.04	0.00	0.01	0.04		
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.28	0.00	0.07	0.21	0.02	0.07
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.29	0.00	0.09	0.20	0.02	0.06
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.02	0.00	0.02	0.01		
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.35	0.00	0.10	0.25	0.03	0.08
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.34	0.00	0.07	0.27	0.02	0.09
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.07	0.00	0.01	0.06		
Story3	Beam	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.46	0.00	0.09	0.37	0.02	0.12
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.43	0.00	0.09	0.34	0.02	0.11
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.11	0.00	0.02	0.09		
Story3	Beam	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.62	0.00	0.12	0.50	0.03	0.16
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.44	0.00	0.09	0.35	0.03	0.11
Story3	Beam	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.07	0.00	0.05	0.02		
Story3	Beam	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.62	0.00	0.10	0.52	0.03	0.16
Story3	Beam	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.19	0.00	0.05	0.14		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(C)	0.14	0.00	0.10	0.04	0.01	0.07
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(T)	0.15	0.01	0.09	0.06		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(C)	0.17	0.00	0.08	0.09	0.01	0.11
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(T)	0.20	0.00	0.04	0.16		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.24	0.00	0.03	0.21	0.01	0.15
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.20	0.00	0.04	0.16		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(C)	0.09	0.00	0.08	0.00	0.01	0.06
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W2+1.0L(T)	0.13	0.00	0.04	0.09		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.14	0.00	0.03	0.12	0.01	0.08

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Design Type	Design Section	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio	V Minor Ratio
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.09	0.00	0.04	0.05		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.18	0.01	0.13	0.05	0.02	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.13	0.00	0.09	0.04		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.19	0.00	0.13	0.05	0.02	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.10	0.00	0.07	0.03		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.40	0.00	0.28	0.11	0.06	0.06
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.19	0.00	0.07	0.12		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.53	0.00	0.41	0.12	0.02	0.05
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.44	0.00	0.27	0.16	0.02	0.05
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.53	0.00	0.41	0.12		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.38	0.01	0.21	0.17	0.06	0.06
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.40	0.00	0.28	0.11		
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W1(C)	0.22	0.01	0.10	0.11	0.02	0.06
Story3	Beam	TUB100X100X3	ELU 0.9D+1.6W1(T)	0.18	0.00	0.07	0.10		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.28	0.00	0.11	0.17	0.02	0.07
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.13	0.00	0.06	0.06		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.45	0.00	0.14	0.31	0.06	0.08
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.27	0.00	0.07	0.20		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.56	0.00	0.39	0.17	0.02	0.06
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.57	0.00	0.39	0.18	0.02	0.06
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.45	0.00	0.27	0.18		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.45	0.01	0.20	0.24	0.06	0.08
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.49	0.00	0.27	0.22		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.25	0.00	0.02	0.23	0.02	0.08
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.19	0.00	0.04	0.15		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.31	0.00	0.07	0.23	0.02	0.09
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.16	0.00	0.01	0.14		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.48	0.01	0.12	0.36	0.04	0.10
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.24	0.00	0.02	0.22		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.46	0.00	0.26	0.20	0.01	0.06
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.17	0.00	0.01	0.16		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.48	0.00	0.26	0.21	0.02	0.07
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.48	0.00	0.13	0.35	0.05	0.09
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.14	0.00	0.05	0.09	0.02	0.03

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Design Type	Design Section	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio	V Minor Ratio
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.10	0.00	0.07	0.02		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.19	0.00	0.07	0.12	0.02	0.04
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.07	0.00	0.07	0.00		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.36	0.00	0.27	0.09	0.06	0.05
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.10	0.00	0.06	0.03		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.45	0.00	0.39	0.06	0.02	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.44	0.00	0.39	0.06	0.02	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.32	0.00	0.27	0.06		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.35	0.01	0.20	0.15	0.06	0.05
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.27	0.00	0.27	0.00		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.18	0.00	0.05	0.13	0.02	0.05
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.12	0.00	0.04	0.08		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.23	0.00	0.05	0.18	0.02	0.06
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.09	0.00	0.02	0.07		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.28	0.01	0.12	0.15	0.04	0.04
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.05	0.00	0.03	0.02		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.28	0.00	0.26	0.02	0.01	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.03	0.00	0.01	0.02		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.27	0.00	0.26	0.01	0.02	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.28	0.01	0.14	0.13	0.05	0.04
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.22	0.00	0.11	0.10	0.03	0.06
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.52	0.22	0.09	0.21	0.03	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.64	0.41	0.02	0.20	0.02	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.16	0.00	0.00	0.16		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.74	0.57	0.03	0.14	0.02	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.12	0.00	0.00	0.12		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.70	0.60	0.03	0.07	0.02	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.07	0.00	0.00	0.07		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.55	0.49	0.06	0.00	0.02	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.03	0.00	0.00	0.02		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.47	0.30	0.14	0.03	0.03	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.02	0.00	0.01	0.01		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.19	0.00	0.08	0.11	0.03	0.05
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.06	0.00	0.01	0.05		

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Design Type	Design Section	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio	V Minor Ratio
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.22	0.00	0.13	0.09	0.03	0.06
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.46	0.06	0.19	0.21	0.03	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.29	0.04	0.01	0.24	0.02	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.24	0.03	0.02	0.19	0.02	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.19	0.03	0.02	0.14	0.02	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.15	0.04	0.01	0.10	0.02	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.26	0.06	0.19	0.01	0.03	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.23	0.00	0.13	0.09	0.03	0.04
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.21	0.00	0.08	0.13	0.02	0.07
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.60	0.31	0.13	0.16	0.03	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.17	0.00	0.00	0.17		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.62	0.38	0.02	0.22	0.02	0.03
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.70	0.50	0.02	0.17	0.02	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.68	0.53	0.02	0.13	0.02	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.55	0.44	0.01	0.10	0.02	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.43	0.27	0.09	0.07	0.03	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.23	0.00	0.11	0.12	0.02	0.05
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.14	0.01	0.04	0.09	0.01	0.04
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.06	0.00	0.01	0.06		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.72	0.55	0.05	0.12	0.02	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.12	0.00	0.01	0.11		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.99	0.82	0.04	0.12	0.02	0.02
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.10	0.00	0.00	0.10		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.91	0.80	0.04	0.07	0.02	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.06	0.00	0.00	0.06		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.95	0.90	0.04	0.01	0.02	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.01	0.00	0.00	0.01		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.94	0.84	0.05	0.05	0.02	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.05	0.00	0.00	0.04		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(C)	0.69	0.56	0.06	0.07	0.02	0.01
Story3	Beam	TUB100X100X3	ELU 1.2D+1.6W1+1.0L(T)	0.07	0.00	0.01	0.07		
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.14	0.01	0.03	0.10	0.01	0.05
Story3	Beam	TUB100X100X3	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.06	0.00	0.00	0.06		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.10	0.06	0.00	0.04	0.00	0.00

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Design Type	Design Section	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio	V Minor Ratio
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.05	0.03	0.01	0.02	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.13	0.05	0.01	0.08	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.09	0.04	0.01	0.04	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.10	0.03	0.00	0.07	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.07	0.01	0.00	0.06	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.09	0.01	0.00	0.08	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.12	0.01	0.00	0.10	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.08	0.00	0.00	0.07		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.07	0.02	0.00	0.05	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.04	0.00	0.00	0.03		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.13	0.04	0.00	0.09	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.06	0.00	0.00	0.05		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.10	0.05	0.01	0.04	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.05	0.00	0.00	0.04		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.12	0.07	0.01	0.04	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.03	0.00	0.00	0.03		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.09	0.07	0.00	0.03	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.03	0.00	0.00	0.02		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.04	0.03	0.01	0.01	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.08	0.03	0.01	0.04	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.05	0.02	0.01	0.02	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.02	0.00	0.00	0.01		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.12	0.03	0.01	0.08	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.08	0.01	0.00	0.07	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.09	0.01	0.00	0.08	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.08	0.01	0.00	0.06	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.04	0.00	0.00	0.04		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.07	0.01	0.00	0.06	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.06	0.00	0.00	0.06		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W2+1.0L(C)	0.09	0.01	0.00	0.08	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W2+1.0L(T)	0.10	0.01	0.00	0.08		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W2+1.0L(C)	0.05	0.02	0.00	0.04	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W2+1.0L(T)	0.07	0.01	0.00	0.06		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W2+1.0L(C)	0.08	0.02	0.00	0.06	0.00	0.01

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Design Type	Design Section	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio	V Minor Ratio
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W2+1.0L(T)	0.10	0.01	0.00	0.09		
Story3	Brace	TUB50X50X2	ELU 0.9D+1.6W2(C)	0.07	0.02	0.00	0.04	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 0.9D+1.6W2(T)	0.08	0.01	0.00	0.07		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.08	0.02	0.01	0.06	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.06	0.01	0.00	0.05		
Story3	Brace	TUB50X50X2	ELU 0.9D+1.6W2(C)	0.06	0.03	0.00	0.03	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 0.9D+1.6W2(T)	0.07	0.01	0.00	0.06		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.05	0.04	0.01	0.01	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.02	0.01	0.00	0.00		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.21	0.08	0.06	0.06	0.00	0.00
Story3	Brace	TUB50X50X2	(T)	0.06	0.02	0.03	0.01	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.18	0.09	0.02	0.08	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.09	0.05	0.01	0.03	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.14	0.05	0.00	0.09	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.05	0.03	0.00	0.02	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.10	0.01	0.01	0.08	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.09	0.02	0.01	0.06	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.01	0.00	0.00	0.01		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.06	0.03	0.00	0.03	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.01	0.00	0.00	0.01		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.13	0.06	0.00	0.07	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.09	0.07	0.01	0.02	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.16	0.09	0.01	0.05	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.12	0.08	0.02	0.01	0.00	0.00
Story3	Brace	TUB50X50X2	(T)	0.04	0.01	0.01	0.02	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.30	0.25	0.02	0.03	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.02	0.00	0.01	0.01	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.05	0.01	0.02	0.02		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.41	0.24	0.02	0.15	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.14	0.09	0.01	0.04	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.24	0.09	0.01	0.14	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.09	0.05	0.01	0.04	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.17	0.04	0.01	0.12	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.13	0.04	0.01	0.08	0.00	0.01

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Design Type	Design Section	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio	V Minor Ratio
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.01	0.01	0.00	0.01		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.09	0.04	0.00	0.05	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.01	0.00	0.00	0.01		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.19	0.09	0.01	0.09	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.22	0.20	0.01	0.01	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.39	0.29	0.02	0.07	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.32	0.26	0.03	0.03	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 0.9D+1.6W1(C)	0.02	0.00	0.01	0.01	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 0.9D+1.6W1(T)	0.05	0.02	0.01	0.01		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.35	0.24	0.03	0.07	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SX-0.3SY(C)	0.04	0.01	0.02	0.01	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SX-0.3SY(T)	0.04	0.01	0.02	0.02		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.50	0.31	0.02	0.17	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.07	0.01	0.00	0.07		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.28	0.22	0.01	0.05	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.01	0.01	0.00	0.00		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.35	0.22	0.01	0.13	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.06	0.01	0.00	0.04		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.08	0.05	0.00	0.03	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.02	0.00	0.00	0.02		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.15	0.04	0.01	0.11	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.04	0.01	0.00	0.03		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.10	0.03	0.00	0.07	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.08	0.03	0.00	0.05	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.17	0.08	0.01	0.09	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.16	0.09	0.01	0.06	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.40	0.27	0.02	0.11	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.28	0.23	0.00	0.05	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W2+1.0L(C)	0.02	0.01	0.01	0.00	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W2+1.0L(T)	0.04	0.02	0.01	0.01		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.17	0.06	0.04	0.07	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 0.9D+1.6W2(C)	0.02	0.00	0.01	0.01	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 0.9D+1.6W2(T)	0.05	0.01	0.02	0.02		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.15	0.05	0.01	0.10	0.00	0.01

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Design Type	Design Section	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio	V Minor Ratio
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.08	0.03	0.01	0.04	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.08	0.03	0.00	0.05	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.03	0.02	0.00	0.01	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.06	0.01	0.00	0.04	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.05	0.01	0.00	0.04	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.03	0.02	0.00	0.01	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.07	0.03	0.00	0.03	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.07	0.03	0.01	0.03	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.10	0.04	0.00	0.06	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.09	0.04	0.00	0.04	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.02	0.01	0.01	0.01	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.01	0.00	0.00	0.01		
Story3	Brace	TUB50X50X2	(T)	0.07	0.02	0.01	0.04	0.00	0.00
Story3	Brace	TUB50X50X2	(T)	0.05	0.02	0.01	0.02	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.04	0.01	0.01	0.02	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.01	0.00	0.00	0.01		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.14	0.07	0.01	0.07	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.15	0.06	0.01	0.08	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.03	0.00	0.00	0.03		
Story3	Brace	TUB50X50X2	(T)	0.09	0.06	0.01	0.02	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.17	0.06	0.01	0.10	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.05	0.02	0.00	0.03		
Story3	Brace	TUB50X50X2	ELU 0.9D+1.6W2(C)	0.04	0.02	0.00	0.02	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 0.9D+1.6W2(T)	0.10	0.06	0.01	0.03		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.12	0.05	0.01	0.06	0.00	0.01
Story3	Brace	TUB50X50X2	(T)	0.06	0.02	0.01	0.03	0.00	0.00
Story3	Brace	TUB50X50X2	(T)	0.05	0.02	0.01	0.02	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 0.9D+1.6W2(C)	0.01	0.00	0.00	0.01	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 0.9D+1.6W2(T)	0.04	0.01	0.00	0.02		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.03	0.00	0.00	0.02	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.02	0.00	0.00	0.02		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.07	0.02	0.01	0.05	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.01	0.00	0.00	0.00		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.03	0.01	0.00	0.02	0.00	0.00

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Design Type	Design Section	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio	V Minor Ratio
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.03	0.01	0.00	0.02		
Story3	Brace	TUB50X50X2	(T)	0.07	0.02	0.00	0.05	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.05	0.03	0.00	0.02	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W2+1.0L(C)	0.01	0.00	0.00	0.01	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W2+1.0L(T)	0.03	0.01	0.01	0.02		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W2+1.0L(C)	0.04	0.01	0.00	0.03	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W2+1.0L(T)	0.07	0.02	0.01	0.05		
Story3	Brace	TUB50X50X2	(T)	0.06	0.02	0.03	0.01	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(C)	0.06	0.01	0.02	0.03	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.6W1+1.0L(T)	0.03	0.00	0.01	0.01		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.11	0.02	0.07	0.03	0.01	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.31	0.24	0.02	0.05	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.11	0.03	0.01	0.07		
Story3	Brace	TUB50X50X2	ELU 0.9D+1.6W1(C)	0.04	0.00	0.02	0.01	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 0.9D+1.6W1(T)	0.14	0.08	0.04	0.02		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.29	0.21	0.02	0.06	0.00	0.01
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.08	0.04	0.01	0.03		
Story3	Brace	TUB50X50X2	ELU 0.9D+1.6W2(C)	0.06	0.04	0.02	0.00	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 0.9D+1.6W2(T)	0.13	0.08	0.04	0.01		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.11	0.02	0.06	0.02	0.01	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.05	0.01	0.04	0.01		
Story3	Brace	TUB50X50X2	(T)	0.06	0.03	0.01	0.03	0.00	0.00
Story3	Brace	TUB50X50X2	(T)	0.05	0.03	0.01	0.01	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 0.9D+1.6W2(C)	0.02	0.01	0.01	0.01	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 0.9D+1.6W2(T)	0.05	0.02	0.01	0.02		
Story3	Brace	TUB50X50X2	ELU 0.9D+1.6W1(C)	0.01	0.00	0.00	0.01	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 0.9D+1.6W1(T)	0.03	0.01	0.01	0.01		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.07	0.03	0.01	0.03	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(T)	0.04	0.01	0.00	0.03		
Story3	Brace	TUB50X50X2	ELU 0.9D-1.0SY-0.3SX(C)	0.04	0.02	0.01	0.01	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 0.9D-1.0SY-0.3SX(T)	0.04	0.02	0.01	0.02		
Story3	Brace	TUB50X50X2	ELU 0.9D+1.6W1(C)	0.02	0.00	0.00	0.01	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 0.9D+1.6W1(T)	0.07	0.03	0.01	0.04		
Story3	Brace	TUB50X50X2	ELU 1.2D+1.0L-1.0SY-0.3SX(C)	0.05	0.04	0.01	0.01	0.00	0.00

MEMORIA DE CÁLCULO ESTRUCTURAL

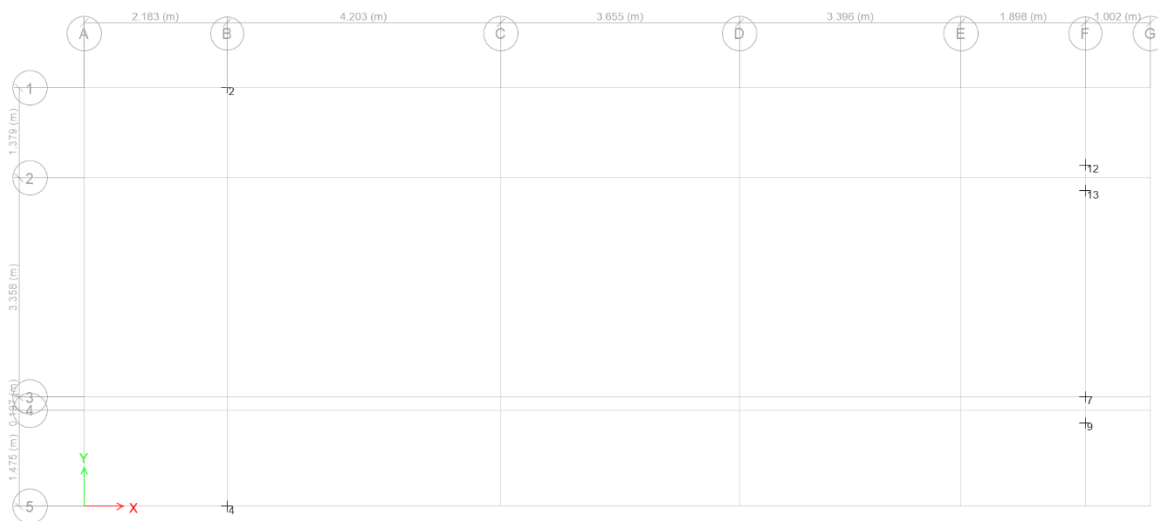
MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Design Type	Design Section	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio	V Minor Ratio
Story3	Brace	TUB50X50X2	ELU 0.9D+1.6W2(C)	0.02	0.01	0.01	0.00	0.00	0.00
Story3	Brace	TUB50X50X2	ELU 0.9D+1.6W2(T)	0.05	0.03	0.01	0.01		

Diseño de elementos de cimentación.

Cargas en la base para diseño de cimentaciones.



Story	Unique Name	Output Case	Case Type	Step Type	FZ	MX	MY
					tonf	tonf-m	tonf-m
Base	2	Live	LinStatic		0.44	0.23	-0.02
Base	2	SX	LinRespSpec	Max	0.31	0.38	12.18
Base	2	SY	LinRespSpec	Max	2.11	7.44	6.46
Base	2	W1	LinStatic		1.55	3.17	3.35
Base	2	W2	LinStatic		-1.35	-2.49	-2.55
Base	2	CIM 1.0D	Combination		5.80	1.36	0.00
Base	4	Live	LinStatic		0.68	-0.20	0.06
Base	4	SX	LinRespSpec	Max	0.14	0.26	12.81
Base	4	SY	LinRespSpec	Max	2.13	7.45	7.47
Base	4	W1	LinStatic		-0.43	2.75	-3.32
Base	4	W2	LinStatic		0.08	-2.02	2.51
Base	4	CIM 1.0D	Combination		6.33	-1.28	0.14

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

Story	Unique Name	Output Case	Case Type	Step Type	FZ	MX	MY
					tonf	tonf-m	tonf-m
Base	7	Live	LinStatic		0.42	0.00	-0.03
Base	7	SX	LinRespSpec	Max	0.10	0.05	0.22
Base	7	SY	LinRespSpec	Max	0.22	1.31	0.09
Base	7	W1	LinStatic		0.55	0.73	-0.07
Base	7	W2	LinStatic		-0.58	-0.55	0.06
Base	7	CIM 1.0D	Combination		1.21	0.00	-0.07
Base	9	Live	LinStatic		0.33	0.00	-0.03
Base	9	SX	LinRespSpec	Max	0.15	0.05	0.22
Base	9	SY	LinRespSpec	Max	1.61	1.30	0.12
Base	9	W1	LinStatic		-0.40	0.73	-0.08
Base	9	W2	LinStatic		0.19	-0.55	0.07
Base	9	CIM 1.0D	Combination		1.16	0.00	-0.07
Base	12	Live	LinStatic		0.08	0.01	-0.02
Base	12	SX	LinRespSpec	Max	0.11	0.05	0.21
Base	12	SY	LinRespSpec	Max	1.59	1.31	0.10
Base	12	W1	LinStatic		0.79	0.73	0.04
Base	12	W2	LinStatic		-0.63	-0.56	-0.02
Base	12	CIM 1.0D	Combination		0.57	0.01	-0.05
Base	13	Live	LinStatic		0.28	0.01	-0.02
Base	13	SX	LinRespSpec	Max	0.08	0.05	0.21
Base	13	SY	LinRespSpec	Max	0.19	1.30	0.07
Base	13	W1	LinStatic		0.18	0.73	0.02
Base	13	W2	LinStatic		-0.24	-0.56	-0.01
Base	13	CIM 1.0D	Combination		0.90	0.01	-0.06

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

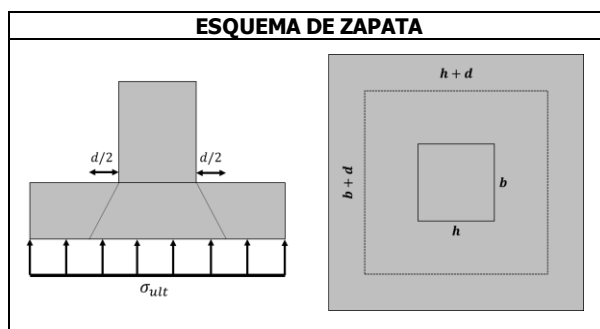
INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

DISEÑO ESTRUCTURAL DE ZAPATA AISLADA CUADRADA - COLUMNAS EJE B

DIMENSIONES DE COLUMNA				REVISIÓN DE LA PRESIÓN DE CONTACTO			
Base	0.50 m		Largo	0.50 m	Pu=1.2Cm+1.6CV=		11.08 Ton
CARGAS Y MOMENTOS DE DISEÑO					φ*0.85*F'c*A1		2900.63 Ton
C. Muerta CM:	6.33 Ton	12.81 Ton-m		Pu<φ*0.85*F'c*A1		¡CUMPLE!	
C. Viva CV:	2.18 Ton	7.45 Ton-m		CARGAS DE SERVICIO			
				Cs=	8.51 Ton	M=	20.26 Ton-m
PRESIÓN ADMISIBLE DEL TERRENO							
Capacidad Portante:		16.00 Ton/m2		e=	2.38 m	AZ=	0.53 m2
MATERIALES				DIMENSIONES PROPUESTAS			
Concreto:		21.00 MPa		H=	2.50 m	B=	2.50 m
Acero de Refuerzo:		420.00 MPa		h=	0.40 m	d=	0.32 m
							6.25 m2

PRESIONES EN EL TERRENO		
T1=	9.14 Ton/m ²	CUMPLE
T2=	-6.42 Ton/m ²	CUMPLE

PRESIONES ÚLTIMAS EN EL TERRENO	
T1=	11.91 Ton/m ²
T2=	-8.36 Ton/m ²



CORTANTE EN DOS DIRECCIONES			
h=	0.50 m	b=	0.50 m
B=	1.00	bo=	328.00 cm
T3=	5.10 Ton/m ²		
T4=	-1.55 Ton/m ²		
Tprom=	1.77 Ton/m ²		
Vu=	9.89 Ton		

PUNZONAMIENTO		
d1=	1.72 cm	CUMPLE
d2=	1.84 cm	CUMPLE
d3=	2.66 cm	CUMPLE

CORTANTE EN UNA DIRECCIÓN					
T5=	6.39 Ton/m ²		Vu=	15.56 Ton	
Tprom=	9.15 Ton/m ²		d=	10.65 cm	CUMPLE
			Vu=	3.01 Ton	
			d=	2.06 cm	CUMPLE

DISEÑO A FLEXIÓN EN DIRECCIÓN LARGA						
T=	3.80 Ton/m ²	p=	0.0012	Ref. Barra	Área	Nº de Barras Separación
Mu=	11.51 Ton-m	As=	14.40 cm ²	#4	1.29 cm ²	12 0.21 m
Rn=	0.50					

DISEÑO A FLEXIÓN EN DIRECCIÓN CORTA						
Mu=	2.22 Ton-m	p=	0.0002	Ref. Barra	Área	Nº de Barras Separación
Rn=	0.10	As=	14.40 cm ²	#4	1.29 cm ²	12 0.21 m

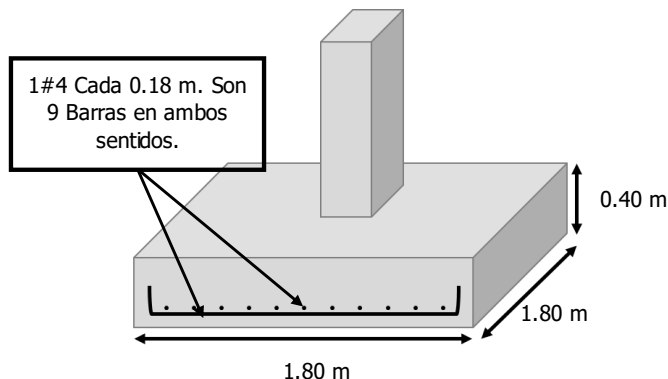
MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

DISEÑO ESTRUCTURAL DE ZAPATA AISLADA CUADRADA - ZAPATA TIPO PEDESTALES

DIMENSIONES DE COLUMNA	
Base	0.70 m
Largo	1.10 m
CARGAS DE DISEÑO	
C. Muerta CM:	8.50 Ton
C. Viva CV:	1.69 Ton
Momento MX:	2.52 Ton-m
Momento MY:	0.37 Ton-m
PRESIÓN ADMISIBLE DEL TERRENO	
Capacidad Portante:	16.00 Ton/m2
MATERIALES	
Concreto:	21.00 MPa
Acero de Refuerzo:	420.00 MPa



REVISIÓN DE LA PRESIÓN DE CONTACTO

$P_u = 1.2CM + 1.6CV =$	12.91 Ton
$\phi * 0.85 * f'c * A1 =$	8933.93 Ton
$P_u \leq \phi 0.85 * f'c * A1$	¡CUMPLE!
$P_s = C_m + C_v =$	10.19 Ton

No se necesita pedestal. El área de acero pasante será la mínima (0.005Ag) y no se requiere fuerza adicional proporcionada por el refuerzo para la transferencia de la carga.

CÁLCULO DE LAS EXCENTRICIDADES

$$e_x = \frac{M_y}{P_s} = 0.04 \text{ m} \quad e_y = \frac{M_x}{P_s} = 0.25 \text{ m}$$

CÁLCULO DE LA PRESIÓN ÚLTIMA DEL TERRENO

La zapata se dimensiona de tal manera que no se sobrepase el esfuerzo admisible del suelo, pero igualmente que tampoco se presenten esfuerzos negativos en la zapata. Para esto, se presta especial atención a los puntos 1 y 3. El máximo esfuerzo se presenta para el punto 3 y el mínimo para el punto 1 y se calculan como:

$$\sigma_1 = \frac{P}{BH} \left(1 - \frac{6e_x}{H} - \frac{6e_y}{B} \right) \geq 0 \quad \sigma_2 = \frac{P}{BH} \left(1 - \frac{6e_x}{H} + \frac{6e_y}{B} \right) \quad \sigma_3 = \frac{P}{BH} \left(1 + \frac{6e_x}{H} + \frac{6e_y}{B} \right) \leq \sigma_{adm}$$

$$\sigma_4 = \frac{P}{BH} \left(1 + \frac{6e_x}{H} - \frac{6e_y}{B} \right)$$

Lado H=	1.80 m
Lado B=	1.80 m

$\bar{I}_x$	$\bar{I}_y$	σ_1	σ_2	σ_3	σ_4
0.87 m4	0.87 m4	0.17 Ton-m2	5.36 Ton-m2	6.12 Ton-m2	0.93 Ton-m2
		¡CUMPLE!		¡CUMPLE!	

Altura h' asumida para la zapata:	0.40 m
Altura efectiva d:	0.32 m

$$A.Z. = \frac{P.S.}{q_u} = 0.64 \text{ m} \quad \sigma_{ult} = \frac{P_u}{AZ} = 3.98 \text{ Ton/m2}$$

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

VERIFICACIÓN DE LAS EXCENTRICIDADES

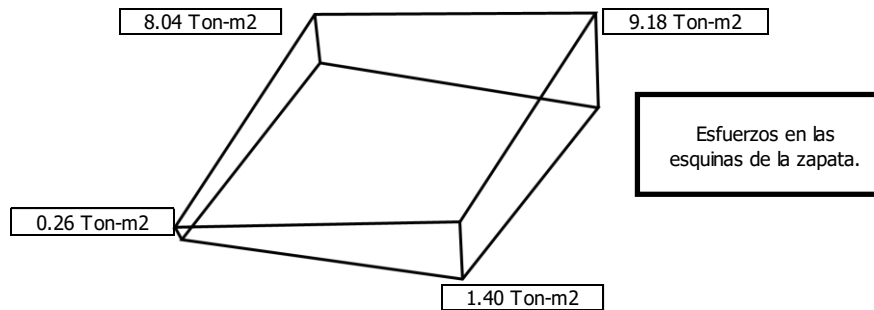
$$e_x \leq \frac{H}{6} = 0.30 \text{ m} \quad \text{¡CUMPLE!}$$

$$e_y \leq \frac{B}{6} = 0.30 \text{ m} \quad \text{¡CUMPLE!}$$

Cálculo de los esfuerzos últimos sobre la zapata. Se asume un coeficiente de mayoración de 1.5 para Ps.

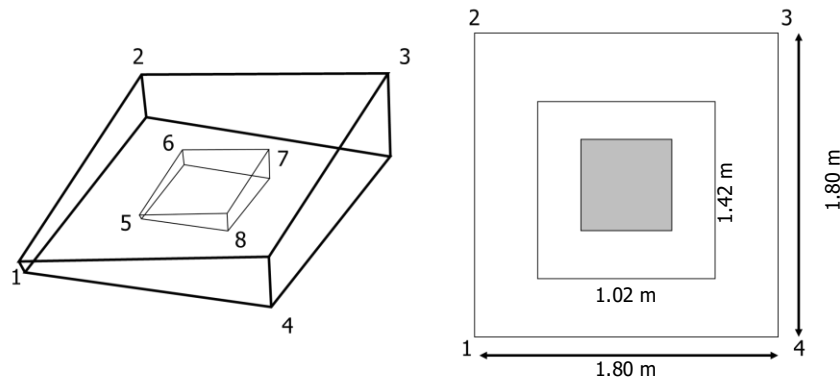
$$1.5P_s = 15.29 \text{ Ton}$$

σ_1	σ_2	σ_3	σ_4
0.26 Ton-m ²	8.04 Ton-m ²	9.18 Ton-m ²	1.40 Ton-m ²



CORTANTE EN DOS DIRECCIONES

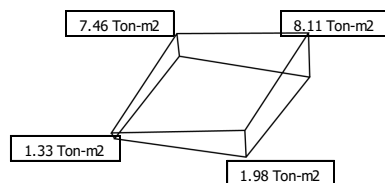
El cortante se evalúa a una distancia $d/2$ de la cara de la columna.



Para esto se deben calcular los esfuerzos en los puntos 5, 6, 7 y 8. Estos esfuerzos pueden calcularse directamente por medio de:

$$\sigma = \frac{Pu}{A} \pm \frac{M_{uy}L_x}{I_y} \pm \frac{M_{ux}L_y}{I_x}$$

σ_5	σ_6	σ_7	σ_8
1.33 Ton-m ²	7.46 Ton-m ²	8.11 Ton-m ²	1.98 Ton-m ²



MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA

VERIFICACIÓN DEL ESPESOR ASUMIDO

$$Vu = Pu - \sigma A = 8.46 \text{ Ton}$$

$$b_0 = 2(h + d) + 2(b + d) = 488.00 \text{ cm}$$

$$d1 = \frac{Vu}{0.75 * 0.17 * \left(1 + \frac{2}{\beta}\right) * \lambda * \sqrt{f'c} * b_0} = 0.99 \text{ cm}$$

$$d > d1$$

¡CUMPLE!

$$d2 = \frac{Vu}{0.75 * 0.083 * \left(\frac{\alpha_s * d_2}{b_0} + 2\right) * \lambda * \sqrt{f'c} * b_0} = 1.06 \text{ cm}$$

$$d > d2$$

¡CUMPLE!

$$d3 = \frac{Vu}{0.75 * 0.33 * \lambda * \sqrt{f'c} * b_0} = 1.53 \text{ cm}$$

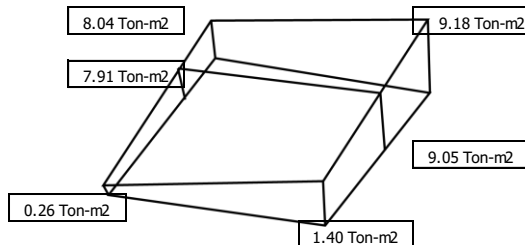
$$d > d3$$

¡CUMPLE!

CORTANTE EN UNA DIRECCIÓN

Se analiza el cortante en la dirección paralela a la que se presentan los esfuerzos mayores (2-3). El cortante se evalúa a una distancia d' de la cara de la columna.

σ_1	σ_2	σ_3	σ_4	σ_{1-2}	σ_{3-4}
0.26 Ton-m ²	8.04 Ton-m ²	9.18 Ton-m ²	1.40 Ton-m ²	7.91 Ton-m ²	9.05 Ton-m ²



$$Vu = \sigma_{ult} * A = 0.46 \text{ Ton}$$

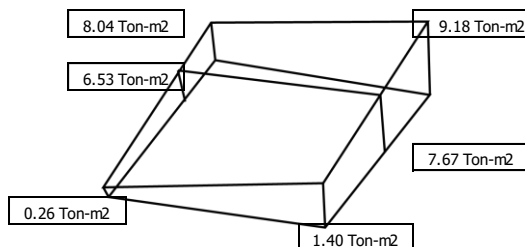
$$d \geq \frac{Vu}{0.75 * 0.17 * \lambda * \sqrt{f'c} * B} = 0.44 \text{ cm}$$

¡CUMPLE!

DISEÑO A FLEXIÓN

Se diseña para la sección más cargada, o sea para una línea paralela a 2-3 pasando por la cara de la columna.

σ_1	σ_2	σ_3	σ_4	σ_{1-2}	σ_{3-4}
0.26 Ton-m ²	8.04 Ton-m ²	9.18 Ton-m ²	1.40 Ton-m ²	6.53 Ton-m ²	7.67 Ton-m ²



$$Vu = \sigma_{ult} * A = 4.95 \text{ Ton}$$

MEMORIA DE CÁLCULO ESTRUCTURAL

MEJORAMIENTO DE LA INFRAESTRUCTURA EDUCATIVA EN DISTINTOS MUNICIPIOS DEL DEPARTAMENTO DEL CESAR

INSTITUCIÓN EDUCATIVA ALVARO ARAUJO NOGUERA EN EL MUNICIPIO DE ASTREA – CESAR - ZONA PORTERIA



$$\bar{X}_{\text{PROMEDIO}} = 0.18 \text{ m}$$

$$Mu = Vu * \bar{X}_{\text{PROMEDIO}} = 0.89 \text{ Ton-m}$$

$$Rn = \frac{Mu}{0.9 * b * d^2} = 0.05 \text{ N/mm}^2 \quad \rho = \frac{0.85 * f'_c}{fy} * \left(1 - \sqrt{1 - \frac{2 * Rn}{0.85 * f'_c}} \right) = 0.0001$$

$$As = \rho * b * d = 10.37 \text{ cm}^2$$

$$\rho_{\text{min}} = 0.0018$$

Ref. Barra	Área	Nº de Barras	Separación
#4	1.29 cm2	9	0.18 m

