

# **MEMORIA DE CÁLCULOS**

## **CENTRO DE INNOVACIÓN Y DESARROLLO TECNOLÓGICO**

### **UNIVERSIDAD TECNOLÓGICA DE PEREIRA**

#### **ESCALERAS BLOQUE “B”**

#### **PEREIRA – RISARALDA**

**T E T R A - Diseños Estructurales**

**Calle 19 # 9 - 50 - Oficina 907**

**Edificio DIARIO DEL OTUN**

**Tel. 324 50 18**

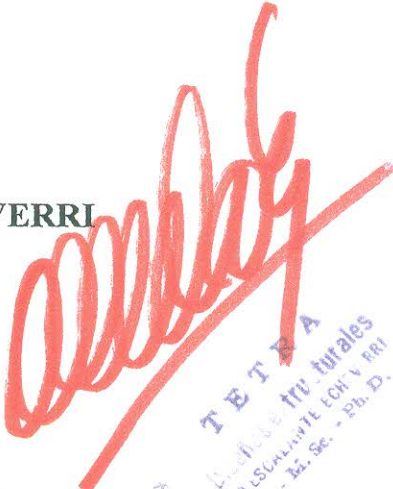
**Pereira - Colombia**

**FERNANDO ESCALANTE ECHEVERRI**

**Ing. Civil, M.Sc., Ph.D.**

**Matr. 25202-46529 Cund.**

**PEREIRA, Diciembre del 2023**



**T E T R A**  
Diseños Estructurales  
FERNANDO ESCALANTE ECHEVERRI  
Ing. Civil - M.Sc. - Ph.D.

Pereira, DICIEMBRE del 2023

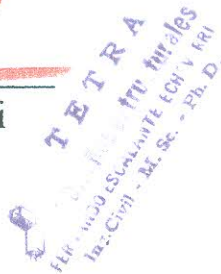
**CURADURÍAS URBANAS  
PEREIRA - RISARALDA**

Yo **FERNANDO ESCALANTE ECHEVERRI**, identificado con la cédula de ciudadanía No. 10'115.846 de Pereira - Risaralda, **INGENIERO CIVIL**, con matrícula profesional No. **25202-46529** de **Cundinamarca**, declaro que el Proyecto Estructural desarrollado por mí, para la construcción de las **ESCALERAS BLOQUE "B"** del **CENTRO DE INNOVACION Y DESARROLLO TECNOLÓGICO** de la **UNIVERSIDAD TECNOLÓGICA DE PEREIRA**, localizado en el sector del **BARRIO LOS ALAMOS** de la ciudad de **PEREIRA – RISARALDA**, sigue las recomendaciones vigentes establecidas para éste tipo de edificaciones en el **NSR-10 REGLAMENTO COLOMBIANO DE CONSTRUCCIÓN SISMO RESISTENTE**. Ley 400 de 1997. Decreto 926 del 19 de marzo de 2010.



---

Fernando Escalante Echeverri  
Ing. Civil, M. Sc., Ph. D.  
Matr. 25202-46529 Cund.



REPUBLICA DE COLOMBIA  
Consejo Profesional Nacional de Ingeniería  
y Arquitectura



MATRÍCULA NO. 2520246529CND  
INGENIERO CIVIL  
APELLIDOS  
ESCALANTE ECHEVERRI  
NOMBRE  
FERNANDO  
C.C. 10.115.846  
UNIVERSIDAD  
DE LOS ANDES

*[Signature]*  
Presidente

*[Red signature]*

TETRA  
Escalante Echeverri  
Ing. Civil - M. Sc. - Ph. D.

## INDICE

INTRODUCCION .....	1
AVALUO DE CARGAS .....	4
FUERZAS SISMICAS .....	5
ESTRUCTURA ANALIZADA .....	10
CARGAS VERTICALES (MUERTA Y VIVA) .....	11
SECCIONES ELEMENTOS .....	15
DATOS DE ENTRADA AL PROGRAMA - E T A B S - PARA PORTICOS TRIDIMENSIONALES .....	16
RESUMEN RESULTADOS DESPLAZAMIENTOS ESTRUCTURA CHEQUEO DE DERIVA PERIODOS DE VIBRACIÓN .....	22
FUERZAS EN LA CIMENTACION .....	29
INDICE SOBRE-ESFUERZO ELEMENTOS .....	34
DISEÑO DE LA CIMENTACION SOBRE ZAPATAS .....	69

# MEMORIA DE CÁLCULOS

## INTRODUCCIÓN

El presente diseño se refiere a la construcción del **BLOQUE “B”** del **CENTRO DE INNOVACION Y DESARROLLO TECNOLÓGICO** de la **UNIVERSIDAD TECNOLÓGICA DE PEREIRA**, localizado en el sector del **BARRIO LOS ALAMOS** de la ciudad de **PEREIRA – RISARALDA**.

## DESCRIPCIÓN ARQUITECTÓNICA

El proyecto consiste de una edificación de cinco (5) pisos. En cada uno de los niveles se localizan una placa que conforman las Escaleras. La estructura NO tiene Cubierta. Las dimensiones aproximadas del lote que ocupa la edificación son: 9.70 metros de frente por 5.65 metros de fondo.

## DATOS GENERALES

El sistema estructural para resistir las fuerzas verticales y horizontales es **PÓRTICOS DE ACERO**. El análisis de la estructura se realizó con el programa de computador **ETABS**, el cual tiene las siguientes características:

- Es Tridimensional.
- Utiliza las hipótesis de diafragma rígido o flexible en las placas de entrepiso.
- Tiene en cuenta deformaciones por cortante de los elementos.
- Incluye zonas rígidas en los nudos formados por vigas y columnas.
- Incluye automáticamente el peso propio de vigas, columnas y pantallas.
- Permite utilizar secciones fisuradas en las vigas.
- Diseña Biaxialmente las columnas, tanto a Flexión como a Cortante.
- Realiza el diseño de vigas, columnas y pantallas siguiendo las recomendaciones del **NSR-10 REGLAMENTO COLOMBIANO DE CONSTRUCCIÓN SISMO RESISTENTE**. Ley 400 de 1997. Decreto 926 del 19 de marzo de 2010.

Además se adjunta la siguiente información:

• Sistema Estructural:	<b>Pórticos de Acero</b>
• Número de Pisos:	<b>Cinco (5) Pisos</b>
• Método de Diseño Estructural:	<b>Estado Límite de Resistencia</b>
• Método de Análisis Sísmico:	<b>Análisis Dinámico Elástico Espectral</b>
• Cortante en la Base:	<b>42.987 ton.</b>
• Sistema de Cimentación:	<b>ZAPATAS amarradas con VIGAS</b>
• Sistema de Placa:	<b>Maciza "Steel Deck"</b>
• Altura de Placa:	<b>10 cm.</b>
• Sistema de Cubierta:	<b>NO HAY</b>
• Carga Muerta:	<b>0.300 ton/m<sup>2</sup> (LOSAS)</b>
• Carga Viva:	<b>0.500 ton/m<sup>2</sup> (LOSAS)</b>
• Zona de Amenaza Sísmica:	<b>Alta</b>
• Capacidad Disipación Energía:	<b>Especial - DES</b>
• Grupo de Uso:	<b>III - Universidades</b>
• Irregularidades en PLANTA:	<b>TIPO 1aP – Torsional Extrema</b>
• Irregularidades en ALTURA:	<b>NO HAY</b>
• Ausencia de REDUNDANCIA:	<b>SI HAY</b>
• Capacidad de Disipación Energía:	<b>R = 0.80 x 0.75 x 7.00 = 4.20</b>

### **MATERIALES**

Concreto de  $f_c = 210 \text{ kg/cm}^2 - 3000 \text{ PSI} - 21 \text{ Mpa}$  de resistencia a la compresión a los 28 días.

Acero  $f_y = 4200 \text{ kg/cm}^2 - 60000 \text{ PSI} - 420 \text{ Mpa}$ .

Acero Perfiles Estructurales A-572  $f_y = 3500 \text{ kg/cm}^2 - 50000 \text{ PSI} - 350 \text{ Mpa}$ .

Tuberia Acero Estruct. A-500 Grado C  $f_y = 3220 \text{ kg/cm}^2 - 46000 \text{ PSI} - 322 \text{ Mpa}$ .

Platinas Acero A-36  $f_y = 2520 \text{ kg/cm}^2 - 36000 \text{ PSI} - 252 \text{ Mpa}$ .

Tornillos Anclaje Acero A-193  $f_y = 7350 \text{ kg/cm}^2 - 105000 \text{ PSI} - 735 \text{ Mpa}$ .

## CIMENTACIÓN

La cimentación se diseñó siguiendo las recomendaciones establecidas en el Estudio de Suelos realizado por la firma ALVARO MILLÁN ANGEL Y CIA. LTDA. con ZAPATAS AISLADAS desplantadas 0.80 m, dimensionadas con una capacidad de trabajo de  $14.5 \text{ ton/m}^2$  ( $1.45 \text{ kg/cm}^2$ ) y unidas en las dos direcciones con vigas de amarre.

En el Diseño Estructural participaron los Ingenieros:



---

Fernando Escalante Echeverri  
Ing. Civil, M. Sc. y Ph. D.  
Matr # 25202 - 46529 de Cund.

**TETRA**  
Diseño Estructural  
Firma: FERNANDO ESCALANTE ECHIVERRI  
Ing. Civil - M. Sc. - Ph. D.

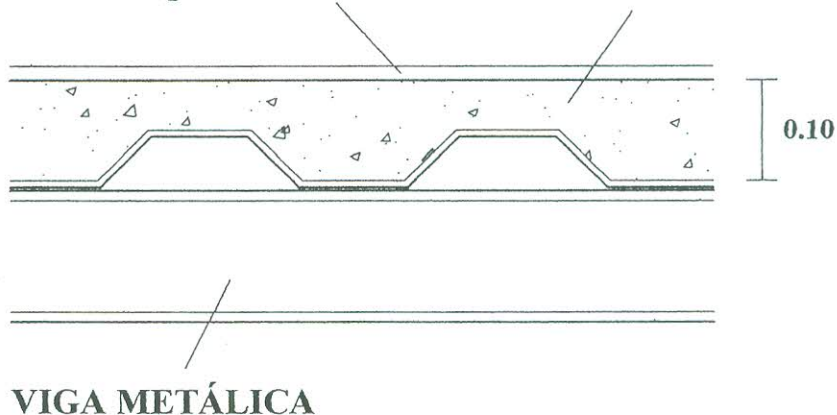
Pereira, Diciembre del 2023.

Proyecto: UNIVERSIDAD TECNOLÓGICA DE PEREIRA  
C I D T - ESCALERAS BLOQUE B  
 Fecha: DICIEMBRE / 2023

### AVALÚO DE CARGAS LOSAS

#### LOSA EN "STEEL DECK"

AFINADO ARQUITECTÓNICO      LOSA DE CONCRETO



#### CARGA MUERTA

LOSA STEEL DECK:	0.190	ton/m <sup>2</sup>
AFINADO ARQUITECTONICO:	0.100	ton/m <sup>2</sup>
CABLEADO E ILUMINACION:	0.010	ton/m <sup>2</sup>

EL PESO DE VIGAS Y VIGUETAS  
SE INCLUYE EN EL ANALISIS

C.M. = 0.300 ton/m<sup>2</sup>

#### CARGA VIVA

C.V. = 0.500 ton/m<sup>2</sup>

**T E T R A - Diseños Estructurales.**

Calle 19 # 9-50 Of. 907 - Edif. DIARIO DEL OTÚN - Tel. 324 50 18

**Fernando Escalante Echeverri**

Ing. Civil - Magister y Ph.D. en Estructuras

ESCALERA BLOQUE B - UTP - PEREIRA

\*\*\* ESPECTRO ELASTICO DE ACELERACIONES \*\*\*

Sa(g) ^

1.016

0.702

0.622

4.560

T(s)

ZONA DE AMENAZA SISMICA ----&gt; ALTA

Aa = 0.25 Av = 0.25 Ad = 0.10

TIPO DE PERFIL DE SUELO ----&gt; D

Fa = 1.30 Fv = 1.90

SISTEMA ESTRUCTURAL DE RESISTENCIA SISMICA

PORTICOS RESISTENTES A MOMENTOS DE ACERO ESTRUCTURAL

Ct = 0.072 Alfa = 0.80 R = 4.20

GRUPO DE USO ----&gt; III I = 1.25

ZONA (3)

 $F_a = 1.44$  $T_c = 0.80 \text{ seg}$  $F_v = 2.40$  $T_L = 5.80 \text{ seg}$ 

$$S_a = 2.5 * 0.25 * 1.44 * 1.25 = 1.125$$

$$S_a = 2.5 * 0.25 * 1.44 * 1.00 = 0.900$$

## ESPECTRO PARA DESPLAZAMIENTOS

T (seg.)	Sa (% g)
0.00	0.900
0.10	0.900
0.20	0.900
0.30	0.900
0.40	0.900
0.50	0.900
0.60	0.900
0.70	0.900
0.80	0.900
0.90	0.800
1.00	0.720
1.10	0.655
1.20	0.600
1.30	0.554
1.40	0.514
1.50	0.480
1.60	0.450
1.70	0.424
1.80	0.400
1.90	0.379
2.00	0.360
2.10	0.343
2.20	0.327
2.30	0.313
2.40	0.300
2.50	0.288

T (seg.)	Sa (% g)
2.60	0.277
2.70	0.267
2.80	0.257
2.90	0.248
3.00	0.240
3.10	0.232
3.20	0.225
3.30	0.218
3.40	0.212
3.50	0.206
3.60	0.200
3.70	0.195
3.80	0.189
3.90	0.185
4.00	0.180
4.10	0.176
4.20	0.171
4.30	0.167
4.40	0.164
4.50	0.160
4.60	0.157
4.70	0.153
4.80	0.150
4.90	0.147
5.00	0.144
5.10	0.141

# ESPECTRO PARA FUERZAS

T (seg.)	Sa (% g)
0.00	1.125
0.10	1.125
0.20	1.125
0.30	1.125
0.40	1.125
0.50	1.125
0.60	1.125
0.70	1.125
0.80	1.125
0.90	1.000
1.00	0.900
1.10	0.818
1.20	0.750
1.30	0.692
1.40	0.643
1.50	0.600
1.60	0.563
1.70	0.529
1.80	0.500
1.90	0.474
2.00	0.450
2.10	0.429
2.20	0.409
2.30	0.391
2.40	0.375
2.50	0.360

T (seg.)	Sa (% g)
2.60	0.346
2.70	0.333
2.80	0.321
2.90	0.310
3.00	0.300
3.10	0.290
3.20	0.281
3.30	0.273
3.40	0.265
3.50	0.257
3.60	0.250
3.70	0.243
3.80	0.237
3.90	0.231
4.00	0.225
4.10	0.220
4.20	0.214
4.30	0.209
4.40	0.205
4.50	0.200
4.60	0.196
4.70	0.191
4.80	0.188
4.90	0.184
5.00	0.180
5.10	0.176

ESPECTRO UMBRAL DE DAÑO

T (seg.)	Sa (% g)
0.00	0.100
0.10	0.180
0.20	0.260
0.25	0.300
0.30	0.300
0.40	0.300
0.50	0.300
0.60	0.300
0.70	0.300
0.80	0.300
0.90	0.300
1.00	0.300
1.10	0.300
1.20	0.300
1.30	0.300
1.40	0.300
1.50	0.300
1.60	0.281
1.70	0.265
1.80	0.250
1.90	0.237
2.00	0.225
2.10	0.214
2.20	0.205
2.30	0.196
2.40	0.188
2.50	0.180

T (seg.)	Sa (% g)
2.60	0.173
2.70	0.167
2.80	0.161
2.90	0.155
3.00	0.150
3.10	0.145
3.20	0.141
3.30	0.136
3.40	0.132
3.50	0.129
3.60	0.125
3.70	0.122
3.80	0.118
3.90	0.115
4.00	0.113
4.10	0.110
4.20	0.107
4.30	0.105
4.40	0.102
4.50	0.100
4.60	0.098
4.70	0.096
4.80	0.094
4.90	0.092
5.00	0.090
5.10	0.088

**Proyecto: UNIVERSIDAD TECNOLÓGICA DE PEREIRA**

**ESCALERAS BLOQUE 15 – B**

**CIDT - UTP**

**Fecha: DICIEMBRE / 2023**

**Hoja #**

**9**

**CHEQUEO RESULTADOS ANALISIS DINAMICO**

Periodo Aproximado  $T_a = 0.072 \times (14.80)^{0.80} = 0.622 \text{ seg.}$

$C_u = 1.75 - 1.2 (A_v) (F_v) = 1.75 - 1.2 (0.25) (2.40) = 1.03$

$C_u = 1.20 \text{ (mínimo).}$

$C_u T_a = 1.20 \times 0.622 \text{ seg.} = 0.746 \text{ seg.}$

**PERIODOS FUNDAMENTALES ANALISIS DINÁMICO (ETABS)**

$T_x = 0.276 \text{ seg.} < C_u \cdot T_a \quad (\text{OK})$

$T_y = 0.715 \text{ seg.} < C_u \cdot T_a \quad (\text{OK})$

$S_a = 2.5 \times 0.25 \times 1.44 \times 1.00 = 0.90$

$V_s = 0.90 \times 53.070 \text{ ton} = 47.763 \text{ ton.}$

Estructura Irregular  $V_s \text{ (CONTROL)} = 0.90 \times 47.763 \text{ ton.} = 42.987 \text{ ton.}$

**Cortante en la Base:**

Espectro X  $V_x = 28.76 \text{ ton.} \quad V_y = 10.59 \text{ ton.}$   
 $V_{\text{total}} = 30.64 \text{ ton.} < 42.987 \text{ ton} \quad (\text{NO})$   
 $\text{Factor} = 9.8 \times 42.987 / 30.64 = 13.749$

Espectro Y  $V_x = 10.59 \text{ ton.} \quad V_y = 25.94 \text{ ton.}$   
 $V_{\text{total}} = 28.02 \text{ ton.} < 42.987 \text{ ton} \quad (\text{NO})$   
 $\text{Factor} = 9.8 \times 42.987 / 28.02 = 15.035$

**T E T R A - Diseños Estructurales.**

**Calle 19 # 9-50 Of. 907 - Edif. DIARIO DEL OTUN - Tel. 324 50 18**

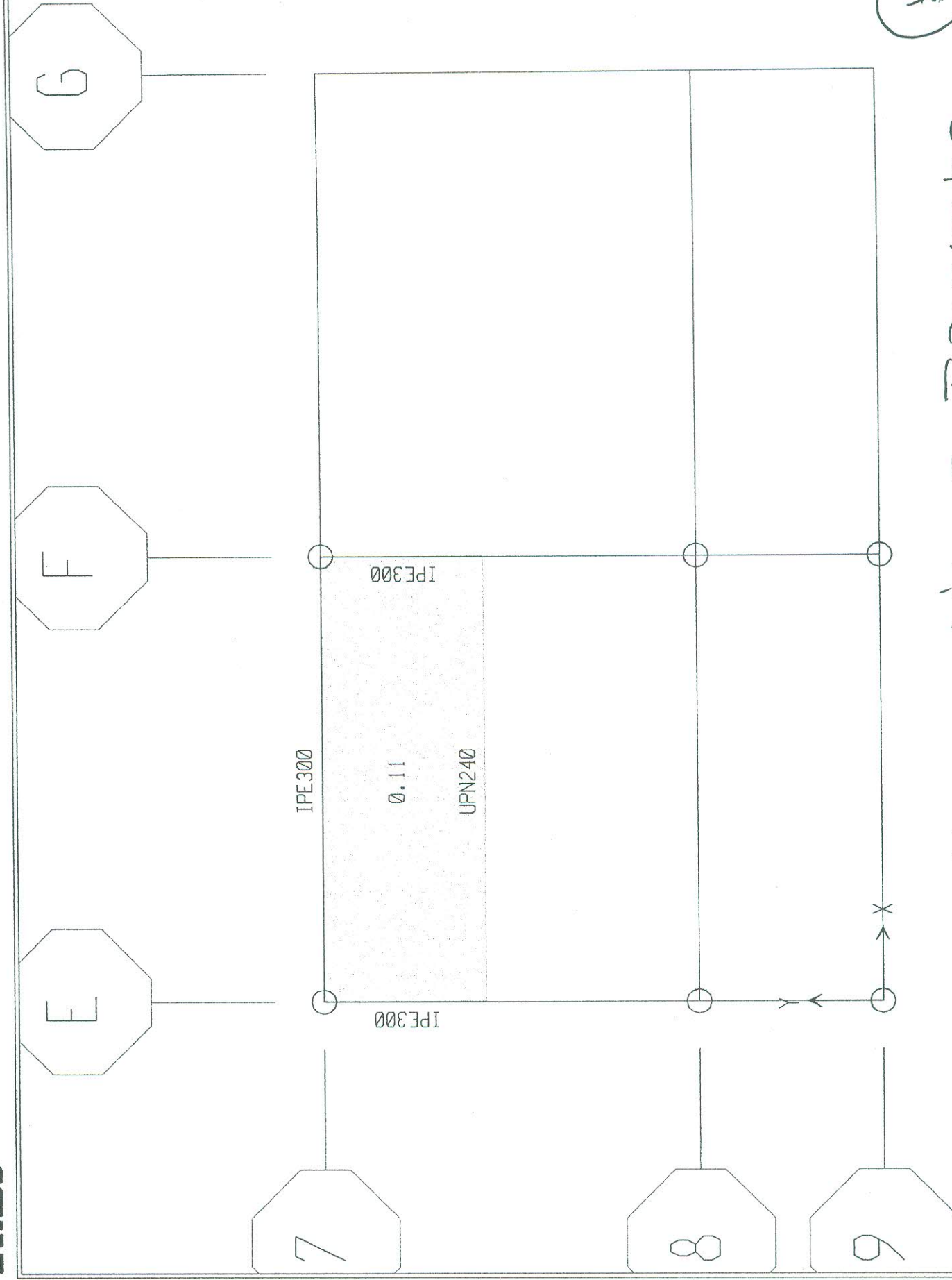
**Fernando Escalante Echeverri**

**Ing. Civil - Magister y Ph.D. en Estructuras**

10

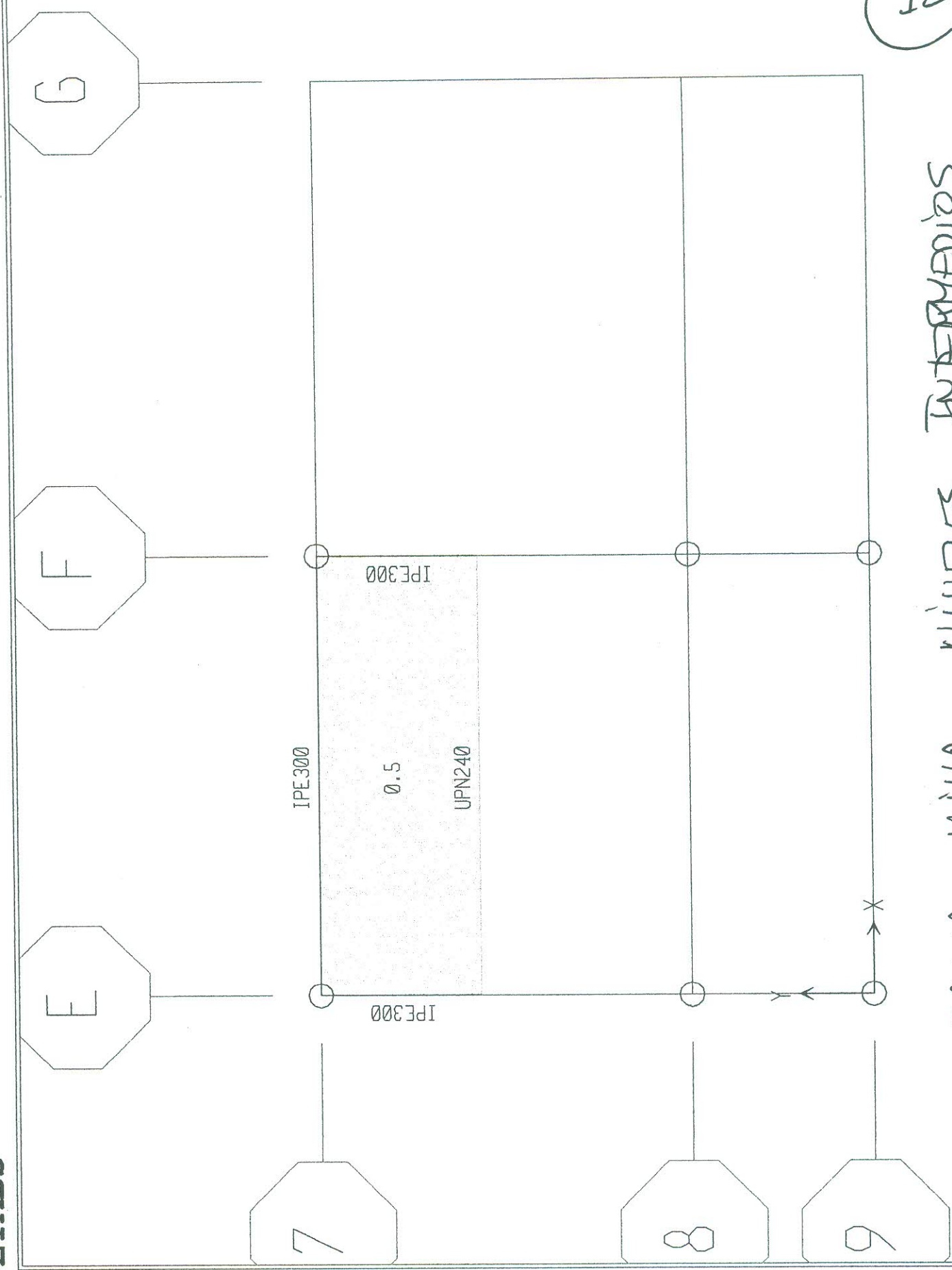


ISOMETRICO ESTRUCTURA



CARGA FUERTA NIVEL INTERMEDIO

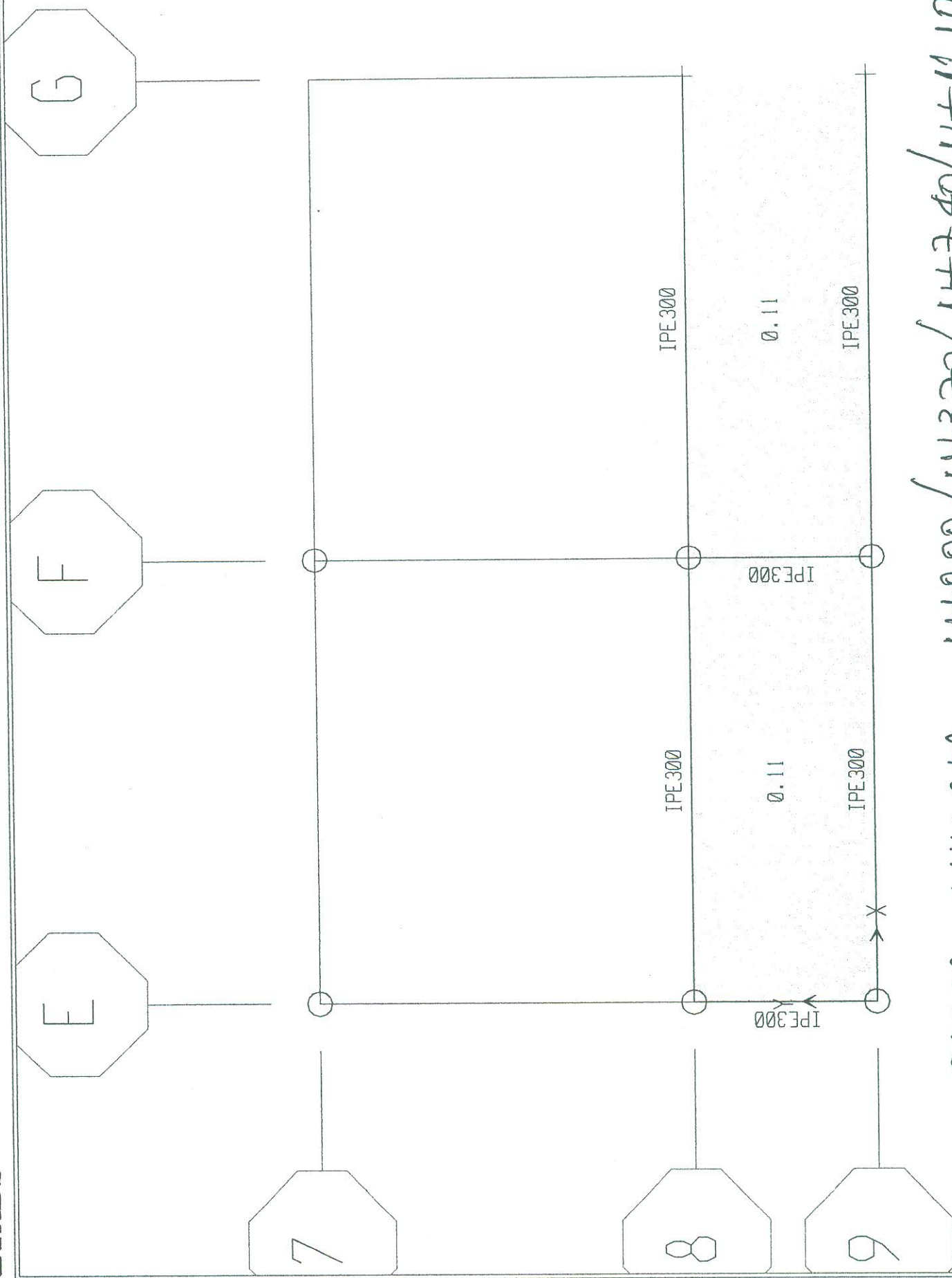
11

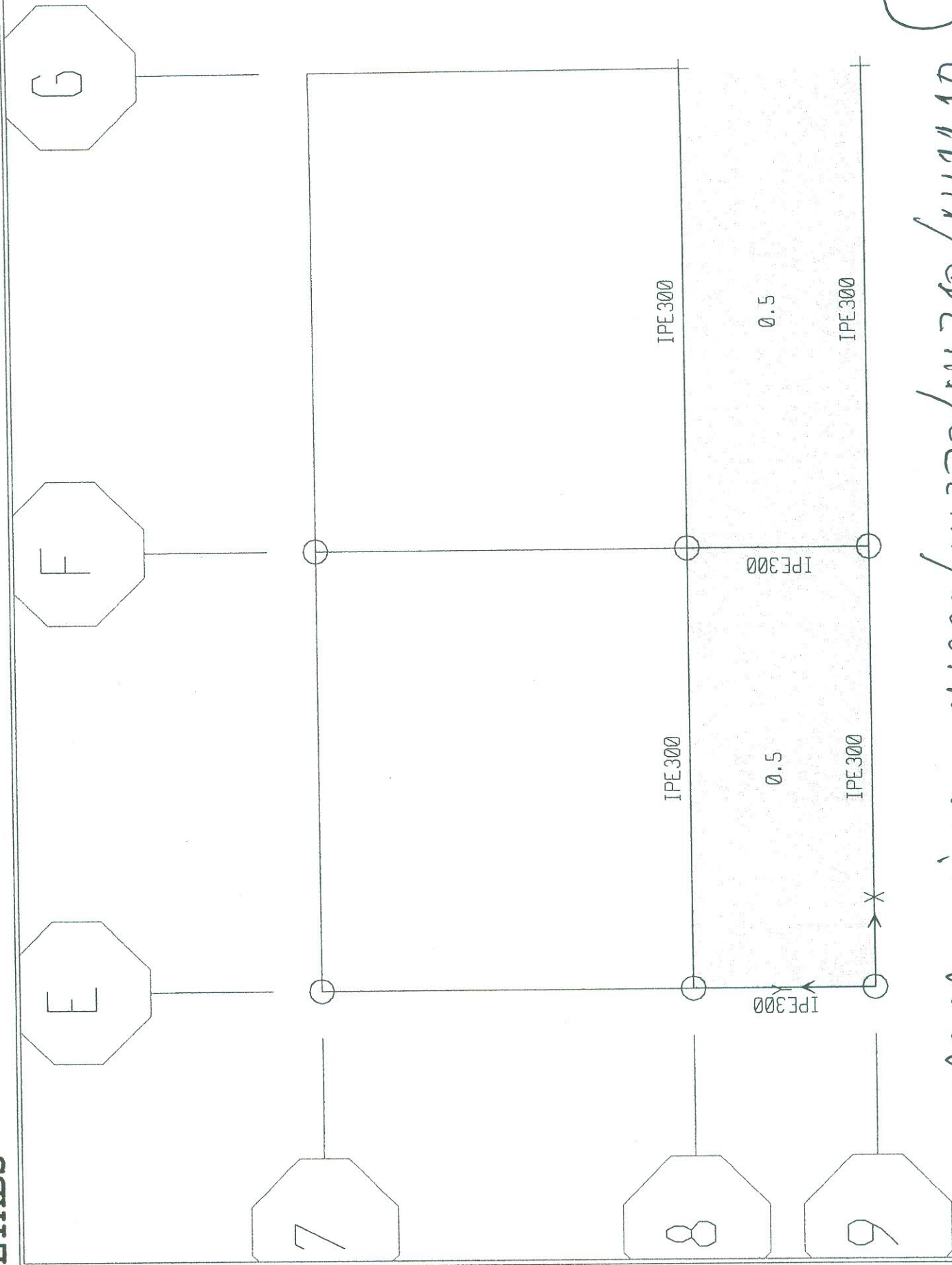


12

CARGA VIVA NIVELES INTERMEDIOS

ETABS

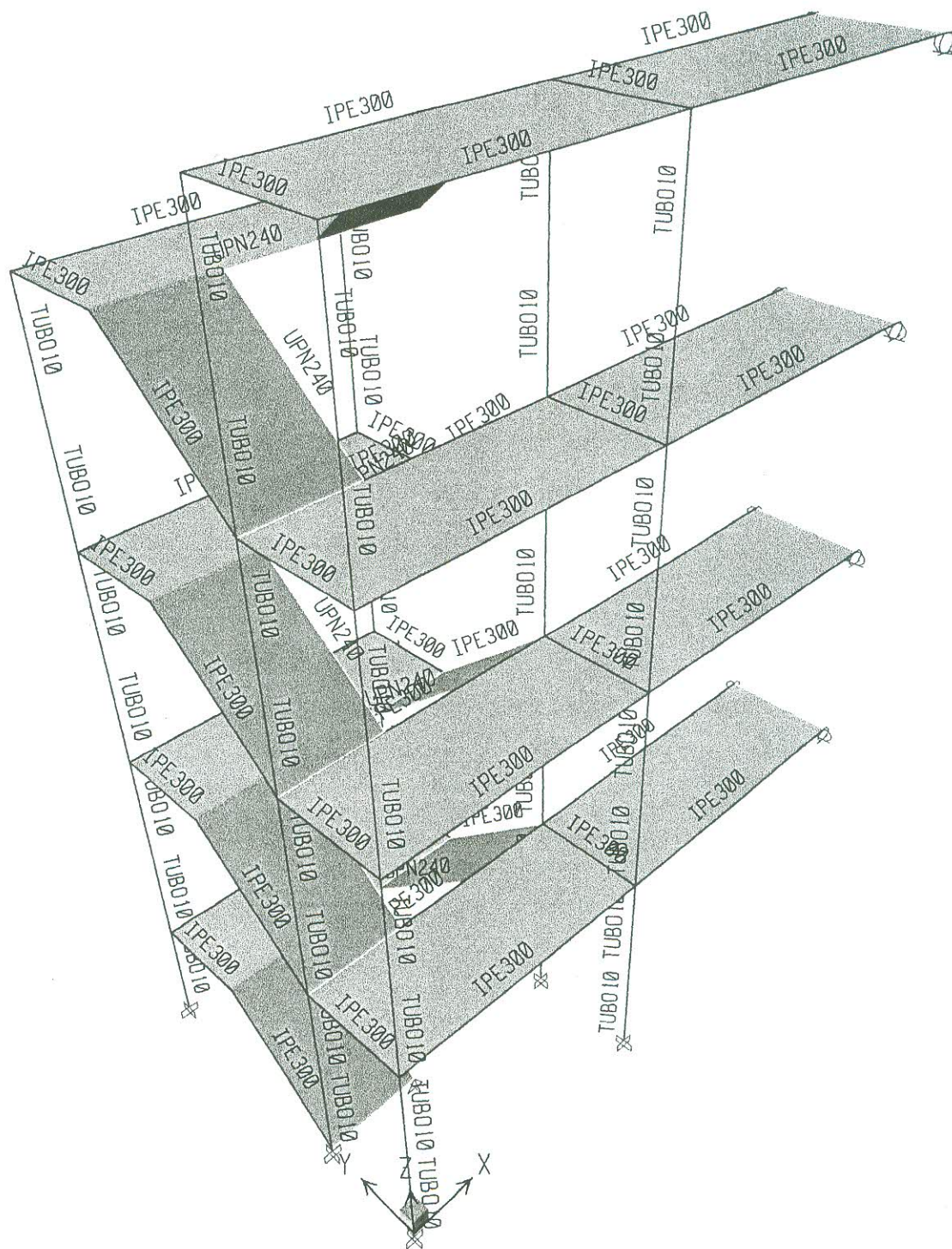




CARGA VIVA N+0.00/N+3.70/N+7.40/N+11.10

14

15



SECCIONES ELEMENTOS

## **T E T R A - Diseños Estructurales**

**Calle 19 # 9 - 50 - Oficina 907**

**Edificio DIARIO DEL OTUN**

**Tel. 324 50 18**

**Pereira - Colombia**

***FERNANDO ESCALANTE ECHEVERRI***

**Ing. Civil, M.Sc., Ph.D.**

**Matr. 25202-46529 Cund.**

**PROGRAMA - E T A B S -**

**PORTICOS TRIDIMENSIONALES**

**DATOS DE ENTRADA**

---

17

ETABS v9.7.2 File:UTP ESCALERA BLOQUE B 2023 Units:Ton-m diciembre 13, 2021 14:56 PAGE 1

# STORY DATA

STORY	SIMILAR TO	HEIGHT	ELEVATION
N+11.10	None	1.850	14.800
N+9.25	None	1.850	12.950
N+7.40	None	1.850	11.100
N+5.55	None	1.850	9.250
N+3.70	None	1.850	7.400
N+1.85	None	1.850	5.550
N+0.00	None	1.850	3.700
N-1.85	None	1.850	1.850
BASE	None		0.000

ETABS v9.7.2 File:UTP ESCALERA BLOQUE B 2023 Units:Ton-m diciembre 13, 2021 14:56 PAGE 2

# MATERIAL PROPERTY DATA

MATERIAL NAME	MATERIAL TYPE	DESIGN TYPE	MATERIAL DIR/PLANE	MODULUS OF ELASTICITY	POISSON'S RATIO	THERMAL COEFF	SHEAR MODULUS
VIGAS	Iso	Steel	All	20389019.200	0.3000	1.1700E-05	7841930.462
CONC	Iso	Concrete	All	2188200.000	0.2000	9.9000E-06	911750.000
OTHER	Iso	None	All	20389019.158	0.3000	1.1700E-05	7841930.445
CONC3500	Iso	Concrete	All	2363520.000	0.2000	9.9000E-06	984800.000
TUBO	Iso	Steel	All	20389019.200	0.3000	1.1700E-05	7841930.462

# MATERIAL PROPERTY MASS AND WEIGHT

MATERIAL NAME	MASS PER UNIT VOL	WEIGHT PER UNIT VOL
VIGAS	7.9810E-01	7.8334E+00
CONC	2.4480E-01	2.4026E+00
OTHER	7.9814E-01	7.8334E+00
CONC3500	2.4000E-01	2.4000E+00
TUBO	7.9810E-01	7.8334E+00

# MATERIAL DESIGN DATA FOR STEEL MATERIALS

MATERIAL NAME	STEEL FY	STEEL FU	STEEL COST (\$)
VIGAS	35153.481	45699.526	27679.91
TUBO	32200.000	41860.000	27679.91

# MATERIAL DESIGN DATA FOR CONCRETE MATERIALS

MATERIAL NAME	LIGHTWEIGHT CONCRETE	CONCRETE FC	REBAR FY	REBAR FYS	LIGHTWT REDUC FACT
CONC	No	2100.000	42000.000	42000.000	N/A
CONC3500	No	2450.000	42000.000	42000.000	N/A

ETABS v9.7.2 File:UTP ESCALERA BLOQUE B 2023 Units:Ton-m diciembre 13, 2021 14:56 PAGE 3

# FRAME SECTION PROPERTY DATA

FRAME SECTION NAME	MATERIAL NAME	SECTION SHAPE NAME OR NAME IN SECTION DATABASE FILE	CONC COL	CONC BEAM
TUBO10	TUBO	Pipe		
IPE300	VIGAS	IPE300		
UPN240	VIGAS	UPN240		

# FRAME SECTION PROPERTY DATA

FRAME SECTION NAME	SECTION DEPTH	FLANGE WIDTH TOP	FLANGE THICK TOP	WEB THICK	FLANGE WIDTH BOT	FLANGE THICK BOT
TUBO10	0.2540	0.2540	0.0000	0.0070	0.2540	0.0000
IPE300	0.3000	0.1500	0.0107	0.0071	0.1500	0.0107
UPN240	0.2400	0.0850	0.0130	0.0095	0.0000	0.0000

## FRAME SECTION PROPERTY DATA

FRAME SECTION NAME	SECTION AREA	TORSIONAL CONSTANT	MOMENTS OF INERTIA		SHEAR AREAS	
			I33	I22	A2	A3
TUBO10	0.0054	0.0001	0.0000	0.0000	0.0028	0.0028
IPE300	0.0054	0.0000	0.0001	0.0000	0.0021	0.0027
UPN240	0.0042	0.0000	0.0000	0.0000	0.0023	0.0018

## FRAME SECTION PROPERTY DATA

FRAME SECTION NAME	SECTION MODULI S33	S22	PLASTIC MODULI		RADIUS OF GYRATION	
			Z33	Z22	R33	R22
TUBO10	0.0003	0.0003	0.0004	0.0004	0.0874	0.0874
IPE300	0.0006	0.0001	0.0006	0.0001	0.1246	0.0335
UPN240	0.0003	0.0000	0.0004	0.0001	0.0922	0.0242

## FRAME SECTION WEIGHTS AND MASSES

FRAME SECTION NAME	TOTAL WEIGHT	TOTAL MASS
TUBO10	3.6210	0.3689
IPE300	5.8301	0.5940
UPN240	1.3612	0.1387

ETADS v9.7.2 File:UTP ESCALERA BLOQUE B 2023 Units:Ton-m diciembre 13, 2021 14:56 PAGE 4

## STATIC LOAD CASES

STATIC CASE	CASE TYPE	AUTO LAT LOAD	SELF WT MULTIPLIER	NOTIONAL FACTOR	NOTIONAL DIRECTION
DEAD	DEAD	N/A	1.0000		
LIVE	LIVE	N/A	0.0000		

ETABS v9.7.2 File:UTP ESCALERA BLOQUE B 2023 Units:Ton-m diciembre 13, 2021 14:56 PAGE 5

## RESPONSE SPECTRUM CASES

RESP SPEC CASE: ESPECX

## BASIC RESPONSE SPECTRUM DATA

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

## RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	ESPECTRO	13.7490
U2	----	N/A
UZ	----	N/A

RESP SPEC CASE: ESPECY

## BASIC RESPONSE SPECTRUM DATA

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

## RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	----	N/A
U2	ESPECTRO	15.0350
UZ	----	N/A

19

RESP SPEC CASE: UMBRX

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0200	0.0000	0.0500

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	UMBRAL	13.7490
U2	----	N/A
UZ	----	N/A

RESP SPEC CASE: UMDRY

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0200	0.0000	0.0500

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	----	N/A
U2	UMBRAL	15.0350
UZ	----	N/A

ETABS v9.7.2 File:UTP ESCALERA BLOQUE B 2023 Units:Ton-m diciembre 13, 2021 14:56 PAGE 6

LOADING COMBINATIONS

COMBO	COMBO TYPE	CASE	CASE TYPE	SCALE FACTOR
COMB1	ADD	DEAD	Static	1.4000
COMB2	ADD	DEAD	Static	1.2000
		LIVE	Static	1.6000
COMB3	ADD	DEAD	Static	1.2000
		LIVE	Static	1.0000
		ESPECX	Spectra	0.2980
		ESPECY	Spectra	0.0890
COMB4	ADD	DEAD	Static	1.2000
		LIVE	Static	1.0000
		ESPECX	Spectra	0.0890
		ESPECY	Spectra	0.2980
COMB5	ADD	DEAD	Static	0.9000
		ESPECX	Spectra	0.2980
		ESPECY	Spectra	0.0890
COMB6	ADD	DEAD	Static	0.9000
		ESPECX	Spectra	0.0890
		ESPECY	Spectra	0.2980
CIMEN1	ADD	DEAD	Static	1.0000
		LIVE	Static	1.0000
CIMEN2	ADD	DEAD	Static	1.0000
		ESPECX	Spectra	0.2080
		ESPECY	Spectra	0.0630
CIMEN3	ADD	DEAD	Static	1.0000
		ESPECX	Spectra	0.0630
		ESPECY	Spectra	0.2080
CIMEN4	ADD	DEAD	Static	1.0000
		LIVE	Static	0.7500
		ESPECX	Spectra	0.1560
		ESPECY	Spectra	0.0470
CIMEN5	ADD	DEAD	Static	1.0000
		LIVE	Static	0.7500
		ESPECX	Spectra	0.0470
		ESPECY	Spectra	0.1560
DSTLS1	ADD	DEAD	Static	1.4000
DSTLS2	ADD	DEAD	Static	1.2000
		LIVE	Static	1.6000

20

DSTLS3	ADD	DEAD	Static	1.4000
		LIVE	Static	0.5000
		ESPECX	Spectra	1.0000
DSTLS4	ADD	DEAD	Static	1.4000
		LIVE	Static	0.5000
		ESPECY	Spectra	1.0000
DSTLS5	ADD	DEAD	Static	1.4000
		LIVE	Static	0.5000
		UMBRX	Spectra	1.0000
DSTLS6	ADD	DEAD	Static	1.4000
		LIVE	Static	0.5000
		UMBRY	Spectra	1.0000
DSTLS7	ADD	DEAD	Static	0.7000
		ESPECX	Spectra	1.0000
DSTLS8	ADD	DEAD	Static	0.7000
		ESPECY	Spectra	1.0000
DSTLS9	ADD	DEAD	Static	0.7000
		UMBRX	Spectra	1.0000
DSTLS10	ADD	DEAD	Static	0.7000
		UMBRY	Spectra	1.0000
DSTLD1	ADD	DEAD	Static	1.0000
DSTLD2	ADD	DEAD	Static	1.0000
		LIVE	Static	1.0000

ETABS v9.7.2 File:UTP ESCALERA BLOQUE B 2023 Units:Ton-m diciembre 13, 2021 14:56 PAGE 7

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

FUNCTION NAME: ESPECTRO

PERIOD	ACCEL
0.0000	0.9000
0.1000	0.9000
0.2000	0.9000
0.3000	0.9000
0.4000	0.9000
0.5000	0.9000
0.6000	0.9000
0.7000	0.9000
0.8000	0.9000
0.9000	0.8000
1.0000	0.7200
1.1000	0.6550
1.2000	0.6000
1.3000	0.5540
1.4000	0.5140
1.5000	0.4800
1.6000	0.4500
1.7000	0.4240
1.8000	0.4000
1.9000	0.3790
2.0000	0.3600
2.1000	0.3430
2.2000	0.3270
2.3000	0.3130
2.4000	0.3000
2.5000	0.2880
2.6000	0.2770
2.7000	0.2670
2.8000	0.2570
2.9000	0.2480
3.0000	0.2400
3.1000	0.2320
3.2000	0.2250
3.3000	0.2100
3.4000	0.2120
3.5000	0.2060
3.6000	0.2000
3.7000	0.1950
3.8000	0.1890
3.9000	0.1850
4.0000	0.1800
4.1000	0.1760
4.2000	0.1710
4.3000	0.1670
4.4000	0.1640
4.5000	0.1600
4.6000	0.1570
4.7000	0.1530
4.8000	0.1500

21

4.9000 0.1470  
5.0000 0.1440

FUNCTION NAME: UMBRAL

PERIOD	ACCEL
0.0000	0.1000
0.1000	0.1000
0.2000	0.2600
0.2500	0.3000
0.3000	0.3000
0.4000	0.3000
0.5000	0.3000
0.6000	0.3000
0.7000	0.3000
0.8000	0.3000
0.9000	0.3000
1.0000	0.3000
1.1000	0.3000
1.2000	0.3000
1.3000	0.3000
1.4000	0.3000
1.5000	0.3000
1.6000	0.2810
1.7000	0.2650
1.8000	0.2500
1.9000	0.2370
2.0000	0.2250
2.1000	0.2140
2.2000	0.2050
2.3000	0.1960
2.4000	0.1880
2.5000	0.1800
2.6000	0.1770
2.7000	0.1670
2.8000	0.1610
2.9000	0.1550
3.0000	0.1500
3.1000	0.1450
3.2000	0.1410
3.3000	0.1360
3.4000	0.1320
3.5000	0.1290
3.6000	0.1250
3.7000	0.1220
3.8000	0.1180
3.9000	0.1150
4.0000	0.1130
4.1000	0.1100
4.2000	0.1070
4.3000	0.1050
4.4000	0.1020
4.5000	0.1000
4.6000	0.0980
4.7000	0.0960
4.8000	0.0940
4.9000	0.0920
5.0000	0.0900
5.1000	0.0880

## **T E T R A - Diseños Estructurales**

**Calle 19 # 9 - 50 - Oficina 907**

**Edificio DIARIO DEL OTUN**

**Tel. 24 50 18**

**Pereira - Colombia**

***FERNANDO ESCALANTE ECHEVERRI***

**Ing. Civil, M.Sc., Ph.D.**

**Matr. 25202-46529 Cund.**

**PROGRAMA - E T A B S -**

**PORTICOS TRIDIMENSIONALES**

**RESUMEN RESULTADOS:**

- DESPLAZAMIENTOS DE LA ESTRUCTURA**
  - CHEQUEO DE DERIVAS**
  - PERIODOS DE VIBRACIÓN**
-

ETABS v9.7.2 File:UTP ESCALERA BLOQUE B 2023 Units:Ton-m diciembre 13, 2021 14:54 PAGE 1

PROJECT INFORMATION

Company Name = tetra

ETABS v9.7.2 File:UTP ESCALERA BLOQUE B 2023 Units:Ton-m diciembre 13, 2021 14:54 PAGE 2

STORY DATA

STORY	SIMILAR TO	HEIGHT	ELEVATION
N+11.10	None	1.850	14.800
N+9.25	None	1.850	12.950
N+7.40	None	1.850	11.100
N+5.55	None	1.850	9.250
N+3.70	None	1.850	7.400
N+1.85	None	1.850	5.550
N+0.00	None	1.850	3.700
N-1.85	None	1.850	1.850
BASE	None		0.000

ETABS v9.7.2 File:UTP ESCALERA BLOQUE B 2023 Units:Ton-m diciembre 13, 2021 14:54 PAGE 3

STATIC LOAD CASES

STATIC CASE	CASE TYPE	AUTO LAT LOAD	SELF WT MULTIPLIER	NOTIONAL FACTOR	NOTIONAL DIRECTION
DEAD	DEAD	N/A	1.0000		
LIVE	LIVE	N/A	0.0000		

ETABS v9.7.2 File:UTP ESCALERA BLOQUE B 2023 Units:Ton-m diciembre 13, 2021 14:54 PAGE 4

RESPONSE SPECTRUM CASES

RESP SPEC CASE: ESPECX

BASIC RESPONSE SPECTRUM DATA

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

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	ESPECTRO	13.7490
U2	----	N/A
UZ	----	N/A

CONNECCION "X"

RESP SPEC CASE: ESPECY

BASIC RESPONSE SPECTRUM DATA

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

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	----	N/A
U2	ESPECTRO	15.0350
UZ	----	N/A

CONNECCION "Y"

RESP SPEC CASE: UMBRX

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
-------------	-----------------	---------------	----------------	---------------

24

SRSS SRSS 0.0200 0.0000 0.0500

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	UMBRAL	13.7490
U2	----	N/A
UZ	----	N/A

RESP SPEC CASE: UMBRY

BASIC RESPONSE SPECTRUM DATA

MODAL COMBO	DIRECTION COMBO	MODAL DAMPING	SPECTRUM ANGLE	TYPICAL ECCEN
SRSS	SRSS	0.0200	0.0000	0.0500

RESPONSE SPECTRUM FUNCTION ASSIGNMENT DATA

DIRECTION	FUNCTION	SCALE FACT
U1	----	N/A
U2	UMBRAL	15.0350
UZ	----	N/A

ETABS v9.7.2 File:UTP ESCALERA BLOQUE B 2023 Units:Ton-m diciembre 13, 2021 14:54 PAGE 5

MASS SOURCE DATA

MASS FROM	LATERAL MASS ONLY	LUMP MASS AT STORIES
Loads	Yes	Yes

MASS SOURCE LOADS

LOAD	MULTIPLIER
DEAD	1.0000

ETABS v9.7.2 File:UTP ESCALERA BLOQUE B 2023 Units:Ton-m diciembre 13, 2021 14:54 PAGE 6

DIAPHRAGM MASS DATA

STORY	DIAPHRAGM	MASS-X	MASS-Y	MMI	X-M	Y-M
N+11.10	D1	7.367E-01	7.367E-01	8.183E+00	4.565	1.031
N+9.25	D1	4.564E-01	4.564E-01	2.281E+00	2.300	4.540
N+7.40	D1	8.368E-01	8.368E-01	9.503E+00	4.146	1.111
N+5.55	D1	4.644E-01	4.644E-01	2.333E+00	2.300	4.559
N+3.70	D1	8.368E-01	8.368E-01	9.503E+00	4.146	1.111
N+1.85	D1	4.644E-01	4.644E-01	2.333E+00	2.300	4.559
N+0.00	D1	8.368E-01	8.368E-01	9.503E+00	4.146	1.111
N-1.85	D1	4.644E-01	4.644E-01	2.333E+00	2.300	4.559

ETABS v9.7.2 File:UTP ESCALERA BLOQUE B 2023 Units:Ton-m diciembre 13, 2021 14:54 PAGE 7

ASSEMBLED POINT MASSES

STORY	UX	UY	UZ	RX	RY	RZ
N+11.10	7.367E-01	7.367E-01	0.000E+00	0.000E+00	0.000E+00	8.183E+00
N+9.25	4.885E-01	4.885E-01	0.000E+00	0.000E+00	0.000E+00	2.281E+00
N+7.40	8.528E-01	8.528E-01	0.000E+00	0.000E+00	0.000E+00	9.503E+00
N+5.55	4.965E-01	4.965E-01	0.000E+00	0.000E+00	0.000E+00	2.333E+00
N+3.70	8.528E-01	8.528E-01	0.000E+00	0.000E+00	0.000E+00	9.503E+00
N+1.85	4.965E-01	4.965E-01	0.000E+00	0.000E+00	0.000E+00	2.333E+00
N+0.00	8.528E-01	8.528E-01	0.000E+00	0.000E+00	0.000E+00	9.503E+00
N-1.85	4.965E-01	4.965E-01	0.000E+00	0.000E+00	0.000E+00	2.333E+00
BASE	1.081E-01	1.081E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Totals	5.381E+00	5.381E+00	0.000E+00	0.000E+00	0.000E+00	4.597E+01

ETABS v9.7.2 File:UTP ESCALERA BLOQUE B 2023 Units:Ton-m diciembre 13, 2021 14:54 PAGE 8

25

# CENTERS OF CUMULATIVE MASS & CENTERS OF RIGIDITY

STORY LEVEL	DIAPHRAGM NAME	-----CENTER OF MASS-----			---CENTER OF RIGIDITY---	
		MASS	ORDINATE-X	ORDINATE-Y	ORDINATE-X	ORDINATE-Y
N+11.10	D1	7.367E-01	4.565	1.031	2.706	3.167
N+9.25	D1	1.193E+00	3.698	2.373	1.813	3.492
N+7.40	D1	2.030E+00	3.883	1.853	2.626	3.175
N+5.55	D1	2.494E+00	3.588	2.356	1.745	3.544
N+3.70	D1	3.331E+00	3.728	2.044	2.812	3.104
N+1.85	D1	3.796E+00	3.553	2.351	1.523	3.673
N+0.00	D1	4.632E+00	3.660	2.127	3.343	2.923
N-1.85	D1	5.097E+00	3.537	2.349	0.925	4.011

ETABS v9.7.2 File:UTP ESCALERA BLOQUE B 2023 Units:Ton-m diciembre 13, 2021 14:54 PAGE 9

## MODAL PERIODS AND FREQUENCIES

MODE NUMBER	PERIOD (TIME)	FREQUENCY (CYCLES/TIME)	CIRCULAR FREQ (RADIAN/TIME)
Mode 1	0.71536	1.39790	8.78327
Mode 2	0.53911	1.85490	11.65470
Mode 3	0.27649	3.61672	22.72453
Mode 4	0.24591	4.06653	25.55078
Mode 5	0.18928	5.28322	33.19543
Mode 6	0.15755	6.34721	39.88070
Mode 7	0.13482	7.41752	46.60563
Mode 8	0.11692	8.55302	53.74019
Mode 9	0.09762	10.24360	64.36247
Mode 10	0.09011	11.09734	69.72664
Mode 11	0.07342	13.61979	85.57565
Mode 12	0.06585	15.18523	95.41159
Mode 13	0.05471	18.27914	114.85125
Mode 14	0.04869	20.53630	129.03335
Mode 15	0.04597	21.75385	136.68350
Mode 16	0.04295	23.28294	146.29105
Mode 17	0.03971	25.10089	158.21621
Mode 18	0.03799	26.32559	165.40854

ETABS v9.7.2 File:UTP ESCALERA BLOQUE B 2023 Units:Ton-m diciembre 13, 2021 14:54 PAGE 10

## MODAL PARTICIPATING MASS RATIOS

MODE NUMBER	X-TRANS %MASS <SUM>	Y-TRANS %MASS <SUM>	Z-TRANS %MASS <SUM>	RX-ROTN %MASS <SUM>	RY-ROTN %MASS <SUM>	RZ-ROTN %MASS <SUM>
Mode 1	3.18 < 3>	47.87 < 48>	0.00 < 0>	63.88 < 64>	4.63 < 5>	28.91 < 29>
Mode 2	11.81 < 15>	26.78 < 75>	0.00 < 0>	33.81 < 98>	14.95 < 20>	40.79 < 70>
Mode 3	59.67 < 75>	0.55 < 75>	0.00 < 0>	0.33 < 98>	79.22 < 99>	13.07 < 83>
Mode 4	0.38 < 75>	7.42 < 83>	0.00 < 0>	0.12 < 98>	0.01 < 99>	2.83 < 86>
Mode 5	4.06 < 79>	1.49 < 84>	0.00 < 0>	0.18 < 98>	0.66 < 99>	3.70 < 89>
Mode 6	0.06 < 79>	4.40 < 89>	0.00 < 0>	0.28 < 99>	0.07 < 100>	0.48 < 90>
Mode 7	0.02 < 79>	1.55 < 90>	0.00 < 0>	0.06 < 99>	0.02 < 100>	1.95 < 92>
Mode 8	0.81 < 80>	4.38 < 94>	0.00 < 0>	0.28 < 99>	0.03 < 100>	0.64 < 92>
Mode 9	9.32 < 89>	0.42 < 95>	0.00 < 0>	0.00 < 99>	0.00 < 100>	0.81 < 93>
Mode 10	0.01 < 89>	1.20 < 96>	0.00 < 0>	0.06 < 99>	0.00 < 100>	0.35 < 94>
Mode 11	2.39 < 92>	0.07 < 96>	0.00 < 0>	0.01 < 99>	0.16 < 100>	0.10 < 94>
Mode 12	1.13 < 93>	0.07 < 96>	0.00 < 0>	0.00 < 99>	0.02 < 100>	0.01 < 94>
Mode 13	0.06 < 93>	0.00 < 96>	0.00 < 0>	0.32 < 99>	0.00 < 100>	0.07 < 94>
Mode 14	0.30 < 93>	0.02 < 96>	0.00 < 0>	0.06 < 99>	0.00 < 100>	0.34 < 94>
Mode 15	0.07 < 93>	0.00 < 96>	0.00 < 0>	0.46 < 100>	0.03 < 100>	0.00 < 94>
Mode 16	0.20 < 93>	0.09 < 96>	0.00 < 0>	0.01 < 100>	0.01 < 100>	0.47 < 95>
Mode 17	0.13 < 94>	0.11 < 96>	0.00 < 0>	0.10 < 100>	0.00 < 100>	0.17 < 95>
Mode 18	0.67 < 94>	0.90 < 97>	0.00 < 0>	0.03 < 100>	0.01 < 100>	2.77 < 97>

ETABS v9.7.2 File:UTP ESCALERA BLOQUE B 2023 Units:Ton-m diciembre 13, 2021 14:54 PAGE 11

## MODAL LOAD PARTICIPATION RATIOS (STATIC AND DYNAMIC RATIOS ARE IN PERCENT)

TYPE	NAME	STATIC	DYNAMIC
Load	DEAD	24.5926	20.5586
Load	LIVE	27.3130	40.7894
Accel	UX	99.9616	94.2764
Accel	UY	99.9942	97.4039
Accel	UZ	0.0000	0.0000
Accel	RX	100.0000	99.9738
Accel	RY	99.9988	99.8174
Accel	RZ	90.1696	97.4580

26

ETABS v9.7.2 File:UTP ESCALERA BLOQUE B 2023 Units:Ton-m diciembre 13, 2021 14:54 PAGE 12

TOTAL REACTIVE FORCES (RECOVERED LOADS) AT ORIGIN

LOAD	FX	FY	FZ	MX	MY	MZ
DEAD	9.381E-15	5.529E-14	5.307E+01	1.241E+02	-1.829E+02	8.272E-04
LIVE	1.316E-14	1.905E-13	6.947E+01	1.613E+02	-2.473E+02	1.192E-03
ESPECX	4.034E+01	1.486E+01	2.699E-12	1.545E+02	4.312E+02	1.601E+02
ESPECY	1.625E+01	3.979E+01	9.648E-12	4.263E+02	1.743E+02	2.141E+02
UMBRX	1.333E+01	4.919E+00	9.419E-13	5.148E+01	1.437E+02	5.259E+01
UMBRY	5.379E+00	1.321E+01	3.219E-12	1.421E+02	5.808E+01	7.090E+01

ETABS v9.7.2 File:UTP ESCALERA BLOQUE B 2023 Units:Ton-m diciembre 13, 2021 14:54 PAGE 13

STORY FORCES

STORY	LOAD	P	VX	VY	T	MX	MY
N+11.10	ESPECX	5.723E-01	1.012E+01	3.844E+00	3.197E+01	7.297E+00	1.397E+01
N+9.25	ESPECX	5.723E-01	1.725E+01	6.192E+00	6.629E+01	1.824E+01	4.552E+01
N+7.40	ESPECX	1.407E+00	2.510E+01	8.851E+00	9.225E+01	3.419E+01	8.361E+01
N+5.55	ESPECX	1.407E+00	3.031E+01	1.077E+01	1.174E+02	5.331E+01	1.393E+02
N+3.70	ESPECX	2.300E+00	3.490E+01	1.271E+01	1.343E+02	7.571E+01	1.943E+02
N+1.85	ESPECX	2.300E+00	3.787E+01	1.392E+01	1.484E+02	1.006E+02	2.635E+02
N+0.00	ESPECX	3.137E+00	3.988E+01	1.459E+01	1.571E+02	1.265E+02	3.283E+02
N-1.85	ESPECX	3.137E+00	4.034E+01	1.486E+01	1.601E+02	1.533E+02	4.018E+02
N+11.10	ESPECY	1.826E-01	6.341E+00	1.085E+01	6.734E+01	2.054E+01	1.270E+01
N+9.25	ESPECY	1.026E-01	6.035E+00	1.590E+01	0.809E+01	5.604E+01	2.362E+01
N+7.40	ESPECY	5.114E-01	1.109E+01	2.493E+01	1.380E+02	9.575E+01	3.917E+01
N+5.55	ESPECY	5.114E-01	1.070E+01	2.896E+01	1.543E+02	1.493E+02	5.876E+01
N+3.70	ESPECY	1.311E+00	1.450E+01	3.473E+01	1.873E+02	2.129E+02	7.850E+01
N+1.85	ESPECY	1.311E+00	1.433E+01	3.707E+01	1.983E+02	2.815E+02	1.047E+02
N+0.00	ESPECY	2.416E+00	1.626E+01	3.916E+01	2.108E+02	3.525E+02	1.265E+02
N-1.85	ESPECY	2.416E+00	1.625E+01	3.979E+01	2.141E+02	4.255E+02	1.562E+02
N+11.10	UMBRX	1.849E-01	3.235E+00	1.211E+00	1.028E+01	2.321E+00	4.446E+00
N+9.25	UMBRX	1.849E-01	5.623E+00	2.000E+00	2.168E+01	5.871E+00	1.475E+01
N+7.40	UMBRX	4.637E-01	8.285E+00	2.920E+00	3.045E+01	1.118E+01	2.737E+01
N+5.55	UMBRX	4.637E-01	1.006E+01	3.573E+00	3.895E+01	1.759E+01	4.596E+01
N+3.70	UMBRX	7.639E-01	1.162E+01	4.218E+00	4.463E+01	2.511E+01	6.446E+01
N+1.85	UMBRX	7.639E-01	1.260E+01	4.626E+00	4.927E+01	3.346E+01	8.769E+01
N+0.00	UMBRX	1.045E+00	1.319E+01	4.846E+00	5.182E+01	4.212E+01	1.094E+02
N-1.85	UMBRX	1.045E+00	1.333E+01	4.919E+00	5.259E+01	5.109E+01	1.339E+02
N+11.10	UMBRY	5.822E-02	2.071E+00	3.585E+00	2.227E+01	6.790E+00	4.153E+00
N+9.25	UMBRY	5.822E-02	1.940E+00	5.304E+00	2.913E+01	1.659E+01	7.673E+00
N+7.40	UMBRY	1.681E-01	3.679E+00	8.295E+00	4.585E+01	3.186E+01	1.291E+01
N+5.55	UMBRY	1.681E-01	3.554E+00	9.638E+00	5.129E+01	4.972E+01	1.946E+01
N+3.70	UMBRY	4.360E-01	4.823E+00	1.157E+01	6.231E+01	7.094E+01	2.609E+01
N+1.85	UMBRY	4.360E-01	4.754E+00	1.235E+01	6.593E+01	9.380E+01	3.485E+01
N+0.00	UMBRY	8.056E-01	5.389E+00	1.302E+01	6.989E+01	1.175E+02	4.214E+01
N-1.85	UMBRY	8.056E-01	5.379E+00	1.321E+01	7.090E+01	1.418E+02	5.206E+01

ETABS v9.7.2 File:UTP ESCALERA BLOQUE B 2023 Units:Ton-m diciembre 13, 2021 14:54 PAGE 14

STORY DRIFTS

STORY	DIRECTION	LOAD	MAX DRIFT
N+11.10	X	ESPECX	1/778
N+9.25	X	ESPECX	1/670
N+7.40	X	ESPECX	1/562
N+5.55	X	ESPECX	1/532
N+3.70	X	ESPECX	1/467
N+1.85	X	ESPECX	1/451
N+0.00	X	ESPECX	1/425
N-1.85	X	ESPECX	1/560
N+11.10	Y	ESPECY	1/234
N+9.25	Y	ESPECY	1/209
N+7.40	Y	ESPECY	1/138
N+5.55	Y	ESPECY	1/131
N+3.70	Y	ESPECY	1/108
N+1.85	Y	ESPECY	1/110
N+0.00	Y	ESPECY	1/108
N-1.85	Y	ESPECY	1/156
N+11.10	X	UMBRX	1/2578
N+9.25	X	UMBRX	1/2201
N+7.40	X	UMBRX	1/1795
N+5.55	X	UMBRX	1/1683
N+3.70	X	UMBRX	1/1443

DERIVA OK  
1/100

N+1.85	X	UMBRX	1/1388
N+0.00	X	UMBRX	1/1305
N-1.85	X	UMBRX	1/1722
N+11.10	Y	UMBRX	1/714
N+9.25	Y	UMBRX	1/635
N+7.40	Y	UMBRX	1/416
N+5.55	Y	UMBRX	1/394
N+3.70	Y	UMBRX	1/324
N+1.85	Y	UMBRX	1/330
N+0.00	Y	UMBRX	1/324
N-1.85	Y	UMBRX	1/471

DERIVA UMBRAL

OK

1/250

ETABS v9.7.2 File:UTP ESCALERA BLOQUE B 2023 Units:Ton-m diciembre 13, 2021 14:54 PAGE 15

DISPLACEMENTS AT DIAPHRAGM CENTER OF MASS

STORY	DIAPHRAGM	LOAD	UX	UY	RZ
N+11.10	D1	ESPECX	0.0211	0.0241	0.00639
N+9.25	D1	ESPECX	0.0161	0.0222	0.00583
N+7.40	D1	ESPECX	0.0168	0.0192	0.00563
N+5.55	D1	ESPECX	0.0121	0.0169	0.00462
N+3.70	D1	ESPECX	0.0115	0.0122	0.00423
N+1.85	D1	ESPECX	0.0066	0.0093	0.00274
N+0.00	D1	ESPECX	0.0054	0.0036	0.00220
N-1.85	D1	ESPECX	0.0009	0.0018	0.00069
N+11.10	D1	ESPECY	0.0450	0.0903	0.01762
N+9.25	D1	ESPECY	0.0152	0.0592	0.01720
N+7.40	D1	ESPECY	0.0367	0.0696	0.01473
N+5.55	D1	ESPECY	0.0131	0.0455	0.01468
N+3.70	D1	ESPECY	0.0254	0.0445	0.01006
N+1.85	D1	ESPECY	0.0083	0.0256	0.00995
N+0.00	D1	ESPECY	0.0115	0.0136	0.00418
N-1.85	D1	ESPECY	0.0017	0.0056	0.00276
N+11.10	D1	UMBRX	0.0066	0.0080	0.00209
N+9.25	D1	UMBRX	0.0046	0.0074	0.00189
N+7.40	D1	UMBRX	0.0053	0.0064	0.00184
N+5.55	D1	UMBRX	0.0035	0.0056	0.00150
N+3.70	D1	UMBRX	0.0037	0.0040	0.00137
N+1.85	D1	UMBRX	0.0019	0.0031	0.00089
N+0.00	D1	UMBRX	0.0017	0.0012	0.00071
N-1.85	D1	UMBRX	0.0003	0.0006	0.00023
N+11.10	D1	UMBRX	0.0149	0.0301	0.00584
N+9.25	D1	UMBRX	0.0050	0.0197	0.00571
N+7.40	D1	UMBRX	0.0122	0.0232	0.00488
N+5.55	D1	UMBRX	0.0043	0.0151	0.00487
N+3.70	D1	UMBRX	0.0004	0.0140	0.00333
N+1.85	D1	UMBRX	0.0027	0.0085	0.00330
N+0.00	D1	UMBRX	0.0038	0.0045	0.00138
N-1.85	D1	UMBRX	0.0006	0.0019	0.00091

ETABS v9.7.2 File:UTP ESCALERA BLOQUE B 2023 Units:Ton-m diciembre 13, 2021 14:54 PAGE 16

STORY MAXIMUM AND AVERAGE LATERAL DISPLACEMENTS

STORY	LOAD	DIR	MAXIMUM	AVERAGE	RATIO
N+11.10	ESPECX	X	0.0260	0.0220	1.183
N+9.25	ESPECX	X	0.0206	0.0206	1.000
N+7.40	ESPECX	X	0.0214	0.0179	1.200
N+5.55	ESPECX	X	0.0157	0.0157	1.000
N+3.70	ESPECX	X	0.0152	0.0124	1.230
N+1.85	ESPECX	X	0.0087	0.0087	1.000
N+0.00	ESPECX	X	0.0075	0.0059	1.277
N-1.85	ESPECX	X	0.0014	0.0014	1.000
N+11.10	ESPECY	Y	0.0908	0.0752	1.208
N+9.25	ESPECY	Y	0.0890	0.0699	1.273
N+7.40	ESPECY	Y	0.0748	0.0627	1.193
N+5.55	ESPECY	Y	0.0728	0.0547	1.331
N+3.70	ESPECY	Y	0.0478	0.0420	1.139
N+1.85	ESPECY	Y	0.0458	0.0319	1.438
N+0.00	ESPECY	Y	0.0167	0.0157	1.066
N-1.85	ESPECY	Y	0.0119	0.0069	1.723
N+11.10	UMBRX	X	0.0084	0.0069	1.208
N+9.25	UMBRX	X	0.0061	0.0061	1.000
N+7.40	UMBRX	X	0.0070	0.0057	1.225
N+5.55	UMBRX	X	0.0047	0.0047	1.000
N+3.70	UMBRX	X	0.0050	0.0040	1.253
N+1.85	UMBRX	X	0.0026	0.0026	1.000
N+0.00	UMBRX	X	0.0024	0.0019	1.293
N-1.85	UMBRX	X	0.0004	0.0004	1.000

28

N+11.10	UMERY	Y	0.0302	0.0250	1.209
N+9.25	UMERY	Y	0.0296	0.0232	1.274
N+7.40	UMERY	Y	0.0249	0.0208	1.194
N+5.55	UMERY	Y	0.0242	0.0182	1.333
N+3.70	UMERY	Y	0.0159	0.0139	1.140
N+1.85	UMERY	Y	0.0152	0.0106	1.441
N+0.00	UMERY	Y	0.0055	0.0052	1.066
N-1.85	UMERY	Y	0.0039	0.0023	1.724

## **T E T R A - Diseños Estructurales**

**Calle 19 # 9 - 50 - Oficina 907**

**Edificio DIARIO DEL OTUN**

**Tel. 24 50 18**

**Pereira - Colombia**

***FERNANDO ESCALANTE ECHEVERRI***

**Ing. Civil, M.Sc., Ph.D.**

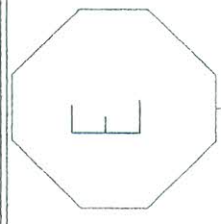
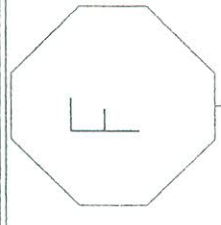
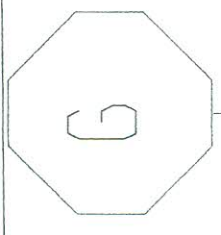
**Matr. 25202-46529 Cund.**

**PROGRAMA - E T A B S -**

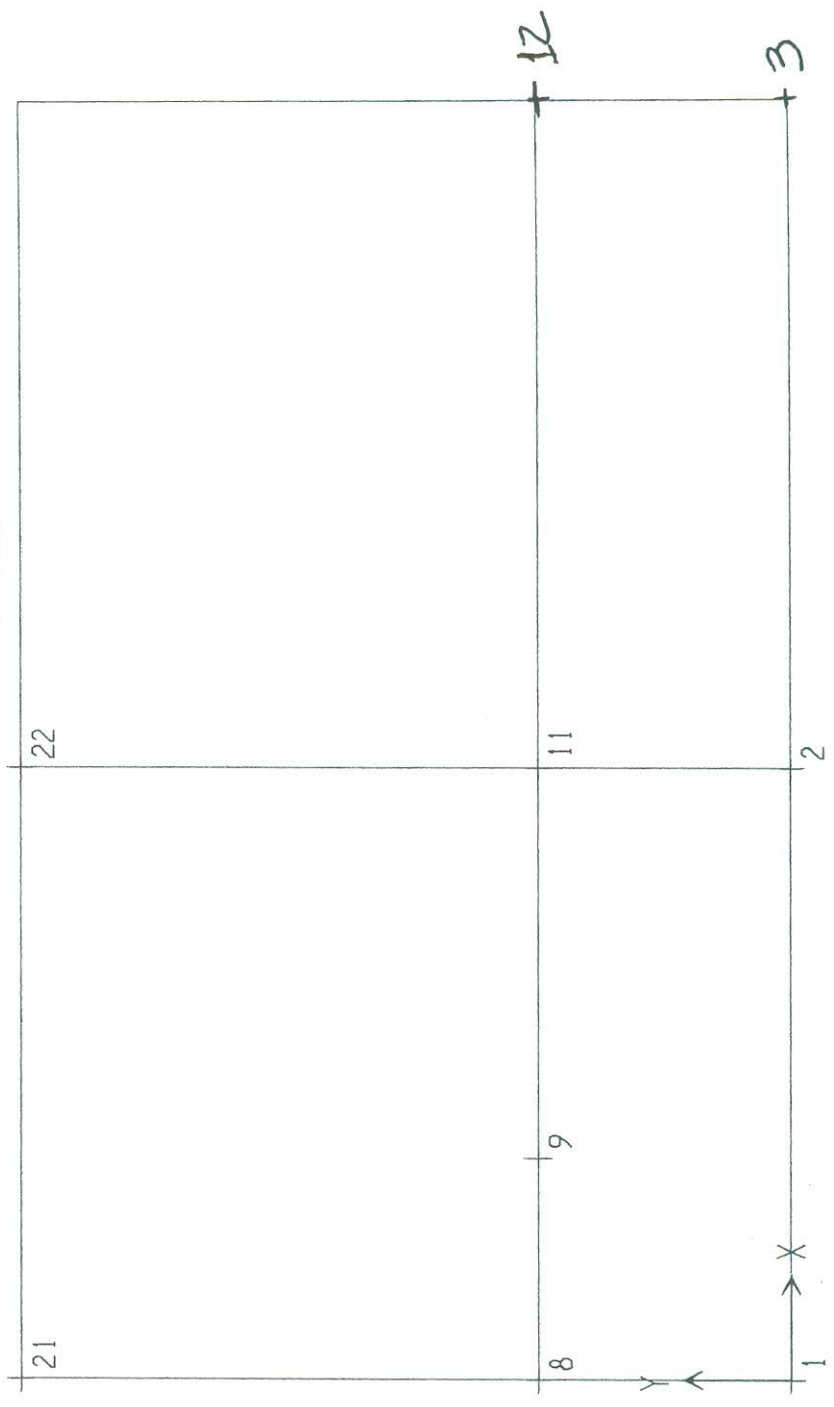
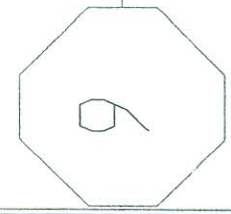
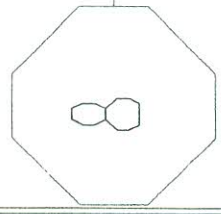
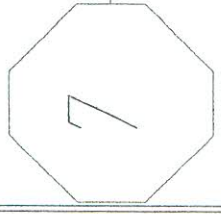
**PORTICOS TRIDIMENSIONALES**

**FUERZAS EN LA CIMENTACION**

---



ES PARA CARGAS EN  
CIMENTACION



31

LOADING COMBINATIONS

COMBO	COMBO TYPE	CASE	CASE TYPE	SCALE FACTOR
CIMEN1	ADD	DEAD	Static	1.0000
		LIVE	Static	1.0000
CIMEN2	ADD	DEAD	Static	1.0000
		ESPECX	Spectra	0.2080
		ESPECY	Spectra	0.0630
CIMEN3	ADD	DEAD	Static	1.0000
		ESPECX	Spectra	0.0630
		ESPECY	Spectra	0.2080
CIMEN4	ADD	DEAD	Static	1.0000
		LIVE	Static	0.7500
		ESPECX	Spectra	0.1560
		ESPECY	Spectra	0.0470
CIMEN5	ADD	DEAD	Static	1.0000
		LIVE	Static	0.7500
		ESPECX	Spectra	0.0470
		ESPECY	Spectra	0.1560

SUPPORT REACTIONS

STORY	POINT	LOAD	FX	FY	FZ	MX	MY	MZ
N+11.10	3	DEAD	0.00	0.00	0.66	0.000	0.000	0.000
N+11.10	3	LIVE	0.00	0.00	0.94	0.000	0.000	0.000
N+11.10	3	CIMEN1	0.00	0.00	1.60	0.000	0.000	0.000
N+11.10	3	CIMEN2 Max	0.00	0.00	0.70	0.000	0.000	0.000
N+11.10	3	CIMEN2 Min	0.00	0.00	0.61	0.000	0.000	0.000
N+11.10	3	CIMEN3 Max	0.00	0.00	0.71	0.000	0.000	0.000
N+11.10	3	CIMEN3 Min	0.00	0.00	0.61	0.000	0.000	0.000
N+11.10	3	CIMEN4 Max	0.00	0.00	1.40	0.000	0.000	0.000
N+11.10	3	CIMEN4 Min	0.00	0.00	1.33	0.000	0.000	0.000
N+11.10	3	CIMEN5 Max	0.00	0.00	1.40	0.000	0.000	0.000
N+11.10	3	CIMEN5 Min	0.00	0.00	1.33	0.000	0.000	0.000
N+11.10	12	DEAD	0.00	0.00	0.64	0.000	0.000	0.000
N+11.10	12	LIVE	0.00	0.00	0.92	0.000	0.000	0.000
N+11.10	12	CIMEN1	0.00	0.00	1.56	0.000	0.000	0.000
N+11.10	12	CIMEN2 Max	0.00	0.00	0.75	0.000	0.000	0.000
N+11.10	12	CIMEN2 Min	0.00	0.00	0.53	0.000	0.000	0.000
N+11.10	12	CIMEN3 Max	0.00	0.00	0.74	0.000	0.000	0.000
N+11.10	12	CIMEN3 Min	0.00	0.00	0.55	0.000	0.000	0.000
N+11.10	12	CIMEN4 Max	0.00	0.00	1.42	0.000	0.000	0.000
N+11.10	12	CIMEN4 Min	0.00	0.00	1.25	0.000	0.000	0.000
N+11.10	12	CIMEN5 Max	0.00	0.00	1.40	0.000	0.000	0.000
N+11.10	12	CIMEN5 Min	0.00	0.00	1.26	0.000	0.000	0.000
N+7.40	3	DEAD	0.00	0.00	0.66	0.000	0.000	0.000
N+7.40	3	LIVE	0.00	0.00	0.94	0.000	0.000	0.000
N+7.40	3	CIMEN1	0.00	0.00	1.60	0.000	0.000	0.000
N+7.40	3	CIMEN2 Max	0.00	0.00	0.76	0.000	0.000	0.000
N+7.40	3	CIMEN2 Min	0.00	0.00	0.55	0.000	0.000	0.000
N+7.40	3	CIMEN3 Max	0.00	0.00	0.79	0.000	0.000	0.000
N+7.40	3	CIMEN3 Min	0.00	0.00	0.52	0.000	0.000	0.000
N+7.40	3	CIMEN4 Max	0.00	0.00	1.44	0.000	0.000	0.000
N+7.40	3	CIMEN4 Min	0.00	0.00	1.29	0.000	0.000	0.000
N+7.40	3	CIMEN5 Max	0.00	0.00	1.47	0.000	0.000	0.000
N+7.40	3	CIMEN5 Min	0.00	0.00	1.26	0.000	0.000	0.000
N+7.40	12	DEAD	0.00	0.00	0.62	0.000	0.000	0.000
N+7.40	12	LIVE	0.00	0.00	0.89	0.000	0.000	0.000
N+7.40	12	CIMEN1	0.00	0.00	1.51	0.000	0.000	0.000
N+7.40	12	CIMEN2 Max	0.00	0.00	0.76	0.000	0.000	0.000
N+7.40	12	CIMEN2 Min	0.00	0.00	0.48	0.000	0.000	0.000
N+7.40	12	CIMEN3 Max	0.00	0.00	0.70	0.000	0.000	0.000
N+7.40	12	CIMEN3 Min	0.00	0.00	0.54	0.000	0.000	0.000
N+7.40	12	CIMEN4 Max	0.00	0.00	1.40	0.000	0.000	0.000
N+7.40	12	CIMEN4 Min	0.00	0.00	1.18	0.000	0.000	0.000
N+7.40	12	CIMEN5 Max	0.00	0.00	1.35	0.000	0.000	0.000
N+7.40	12	CIMEN5 Min	0.00	0.00	1.23	0.000	0.000	0.000
N+3.70	3	DEAD	0.00	0.00	0.65	0.000	0.000	0.000
N+3.70	3	LIVE	0.00	0.00	0.94	0.000	0.000	0.000

N+3.70	3	CIMEN1	0.00	0.00	1.59	0.000	0.000	0.000
N+3.70	3	CIMEN2 Max	0.00	0.00	0.78	0.000	0.000	0.000
N+3.70	3	CIMEN2 Min	0.00	0.00	0.52	0.000	0.000	0.000
N+3.70	3	CIMEN3 Max	0.00	0.00	0.85	0.000	0.000	0.000
N+3.70	3	CIMEN3 Min	0.00	0.00	0.45	0.000	0.000	0.000
N+3.70	3	CIMEN4 Max	0.00	0.00	1.45	0.000	0.000	0.000
N+3.70	3	CIMEN4 Min	0.00	0.00	1.25	0.000	0.000	0.000
N+3.70	3	CIMEN5 Max	0.00	0.00	1.50	0.000	0.000	0.000
N+3.70	3	CIMEN5 Min	0.00	0.00	1.20	0.000	0.000	0.000
N+3.70	12	DEAD	0.00	0.00	0.61	0.000	0.000	0.000
N+3.70	12	LIVE	0.00	0.00	0.88	0.000	0.000	0.000
N+3.70	12	CIMEN1	0.00	0.00	1.49	0.000	0.000	0.000
N+3.70	12	CIMEN2 Max	0.00	0.00	0.78	0.000	0.000	0.000
N+3.70	12	CIMEN2 Min	0.00	0.00	0.44	0.000	0.000	0.000
N+3.70	12	CIMEN3 Max	0.00	0.00	0.72	0.000	0.000	0.000
N+3.70	12	CIMEN3 Min	0.00	0.00	0.50	0.000	0.000	0.000
N+3.70	12	CIMEN4 Max	0.00	0.00	1.40	0.000	0.000	0.000
N+3.70	12	CIMEN4 Min	0.00	0.00	1.14	0.000	0.000	0.000
N+3.70	12	CIMEN5 Max	0.00	0.00	1.36	0.000	0.000	0.000
N+3.70	12	CIMEN5 Min	0.00	0.00	1.19	0.000	0.000	0.000
N+0.00	3	DEAD	0.00	0.00	0.64	0.000	0.000	0.000
N+0.00	3	LIVE	0.00	0.00	0.92	0.000	0.000	0.000
N+0.00	3	CIMEN1	0.00	0.00	1.56	0.000	0.000	0.000
N+0.00	3	CIMEN2 Max	0.00	0.00	0.78	0.000	0.000	0.000
N+0.00	3	CIMEN2 Min	0.00	0.00	0.50	0.000	0.000	0.000
N+0.00	3	CIMEN3 Max	0.00	0.00	0.86	0.000	0.000	0.000
N+0.00	3	CIMEN3 Min	0.00	0.00	0.42	0.000	0.000	0.000
N+0.00	3	CIMEN4 Max	0.00	0.00	1.44	0.000	0.000	0.000
N+0.00	3	CIMEN4 Min	0.00	0.00	1.22	0.000	0.000	0.000
N+0.00	3	CIMEN5 Max	0.00	0.00	1.49	0.000	0.000	0.000
N+0.00	3	CIMEN5 Min	0.00	0.00	1.17	0.000	0.000	0.000
N+0.00	12	DEAD	0.00	0.00	0.61	0.000	0.000	0.000
N+0.00	12	LIVE	0.00	0.00	0.88	0.000	0.000	0.000
N+0.00	12	CIMEN1	0.00	0.00	1.50	0.000	0.000	0.000
N+0.00	12	CIMEN2 Max	0.00	0.00	0.79	0.000	0.000	0.000
N+0.00	12	CIMEN2 Min	0.00	0.00	0.43	0.000	0.000	0.000
N+0.00	12	CIMEN3 Max	0.00	0.00	0.76	0.000	0.000	0.000
N+0.00	12	CIMEN3 Min	0.00	0.00	0.47	0.000	0.000	0.000
N+0.00	12	CIMEN4 Max	0.00	0.00	1.41	0.000	0.000	0.000
N+0.00	12	CIMEN4 Min	0.00	0.00	1.14	0.000	0.000	0.000
N+0.00	12	CIMEN5 Max	0.00	0.00	1.39	0.000	0.000	0.000
N+0.00	12	CIMEN5 Min	0.00	0.00	1.16	0.000	0.000	0.000
BASE	21	DEAD	0.18	-0.47	5.87	0.418	0.106	-0.014
BASE	21	LIVE	0.25	-0.65	7.34	0.584	0.156	-0.022
BASE	21	CIMEN1	0.43	-1.12	13.20	1.003	0.262	-0.036
BASE	21	CIMEN2 Max	1.06	0.30	12.75	1.173	1.188	0.209
BASE	21	CIMEN2 Min	-0.71	-1.23	1.01	-0.336	-0.975	-0.237
BASE	21	CIMEN3 Max	1.86	0.57	14.15	1.458	2.120	0.420
BASE	21	CIMEN3 Min	-1.50	-1.50	2.41	-0.621	-1.908	-0.448
BASE	21	CIMEN4 Max	1.03	-0.38	16.52	1.422	1.032	0.137
BASE	21	CIMEN4 Min	-0.29	-1.53	6.22	0.291	-0.586	-0.197
BASE	21	CIMEN5 Max	1.63	-0.18	17.57	1.635	1.733	0.295
BASE	21	CIMEN5 Min	-0.09	-1.73	5.16	0.070	-1.207	-0.356
BASE	22	DEAD	-0.16	-0.63	6.97	0.604	-0.086	-0.014
BASE	22	LIVE	-0.21	-0.90	8.92	0.870	-0.114	-0.022
BASE	22	CIMEN1	-0.37	-1.53	15.89	1.474	-0.201	-0.036
BASE	22	CIMEN2 Max	0.73	2.11	15.55	3.580	0.995	0.209
BASE	22	CIMEN2 Min	-1.04	-3.38	1.60	-2.371	-1.168	-0.237
BASE	22	CIMEN3 Max	1.52	4.62	20.63	6.271	1.927	0.420
BASE	22	CIMEN3 Min	-1.84	-5.89	6.68	-5.063	-2.100	-0.448
BASE	22	CIMEN4 Max	0.34	0.74	20.08	3.482	0.636	0.137
BASE	22	CIMEN4 Min	-0.98	-3.36	7.25	-0.969	-0.981	-0.197
BASE	22	CIMEN5 Max	0.94	2.63	23.90	5.505	1.337	0.295
BASE	22	CIMEN5 Min	-1.58	-5.25	3.43	-2.992	-1.682	-0.356
BASE	8	DEAD	0.21	-0.77	8.58	0.428	0.079	0.120
BASE	8	LIVE	0.30	-1.16	11.08	0.566	0.129	0.161
BASE	8	CIMEN1	0.51	-1.93	19.66	0.994	0.208	0.281
BASE	8	CIMEN2 Max	4.79	11.02	28.70	3.352	0.380	1.620
BASE	8	CIMEN2 Min	-4.37	-12.57	11.54	-2.495	-0.222	-1.381
BASE	8	CIMEN3 Max	3.51	7.49	18.47	4.265	0.509	2.715
BASE	8	CIMEN3 Min	-3.09	-9.04	1.31	-3.409	-0.352	-2.475
BASE	8	CIMEN4 Max	3.87	7.19	31.97	3.041	0.401	1.363
BASE	8	CIMEN4 Min	-3.00	-10.48	1.81	-1.336	-0.049	-0.882
BASE	8	CIMEN5 Max	2.91	4.54	24.28	3.728	0.498	2.186
BASE	8	CIMEN5 Min	-2.04	-7.83	9.50	-2.023	-0.147	-1.704

33

BASE	11	DEAD	0.00	-0.05	13.88	0.124	0.016	-0.021
BASE	11	LIVE	0.00	-0.08	18.77	0.183	0.025	-0.030
BASE	11	CIMEN1	0.00	-0.13	32.65	0.306	0.040	-0.051
BASE	11	CIMEN2 Max	0.51	0.35	24.70	1.033	0.961	0.233
BASE	11	CIMEN2 Min	-0.52	-0.45	3.07	-0.785	-0.929	-0.275
BASE	11	CIMEN3 Max	0.73	0.72	20.42	1.883	1.403	0.334
BASE	11	CIMEN3 Min	-0.73	-0.82	7.35	-1.636	-1.372	-0.376
BASE	11	CIMEN4 Max	0.38	0.19	36.07	0.940	0.741	0.147
BASE	11	CIMEN4 Min	-0.39	-0.41	19.85	-0.419	-0.673	-0.233
BASE	11	CIMEN5 Max	0.55	0.47	32.05	1.500	1.074	0.222
BASE	11	CIMEN5 Min	-0.55	-0.69	23.07	-1.058	-1.006	-0.309
BASE	1	DEAD	0.05	0.04	3.01	-0.062	0.051	-0.021
BASE	1	LIVE	0.07	0.06	3.22	-0.086	0.078	-0.030
BASE	1	CIMEN1	0.13	0.11	6.22	-0.149	0.129	-0.051
BASE	1	CIMEN2 Max	0.71	0.97	9.28	1.847	1.491	0.233
BASE	1	CIMEN2 Min	-0.61	-0.88	3.27	-1.972	-1.388	-0.275
BASE	1	CIMEN3 Max	1.01	1.21	11.38	2.377	2.163	0.334
BASE	1	CIMEN3 Min	-0.91	-1.12	5.37	-2.502	-2.061	-0.376
BASE	1	CIMEN4 Max	0.60	0.78	10.12	1.303	1.187	0.147
BASE	1	CIMEN4 Min	-0.39	-0.60	0.72	-1.557	-0.968	-0.233
BASE	1	CIMEN5 Max	0.83	0.97	11.70	1.701	1.693	0.222
BASE	1	CIMEN5 Min	-0.61	-0.79	0.85	-1.955	-1.474	-0.309
BASE	2	DEAD	0.02	-0.03	7.62	0.095	0.009	-0.021
BASE	2	LIVE	0.03	-0.04	9.85	0.137	0.019	-0.030
BASE	2	CIMEN1	0.04	-0.07	17.48	0.233	0.028	-0.051
BASE	2	CIMEN2 Max	0.76	0.37	14.63	0.993	1.554	0.233
BASE	2	CIMEN2 Min	-0.73	-0.42	0.62	-0.802	-1.535	-0.275
BASE	2	CIMEN3 Max	1.10	0.74	19.99	1.848	2.280	0.334
BASE	2	CIMEN3 Min	-1.07	-0.80	4.74	-1.657	-2.262	-0.376
BASE	2	CIMEN4 Max	0.59	0.24	20.25	0.869	1.179	0.147
BASE	2	CIMEN4 Min	-0.52	-0.36	9.77	-0.473	-1.132	-0.233
BASE	2	CIMEN5 Max	0.85	0.52	24.28	1.512	1.726	0.222
BASE	2	CIMEN5 Min	-0.77	-0.64	5.75	-1.116	-1.679	-0.309
BASE	9	DEAD	-0.30	1.91	2.05	0.000	0.000	0.000
BASE	9	LIVE	-0.44	2.77	2.98	0.000	0.000	0.000
BASE	9	CIMEN1	-0.74	4.68	5.03	0.000	0.000	0.000
BASE	9	CIMEN2 Max	4.29	12.14	10.85	0.000	0.000	0.000
BASE	9	CIMEN2 Min	-4.89	-8.32	6.75	0.000	0.000	0.000
BASE	9	CIMEN3 Max	2.54	7.69	7.02	0.000	0.000	0.000
BASE	9	CIMEN3 Min	-3.14	-3.87	2.92	0.000	0.000	0.000
BASE	9	CIMEN4 Max	2.82	11.66	10.88	0.000	0.000	0.000
BASE	9	CIMEN4 Min	-4.07	-3.68	2.31	0.000	0.000	0.000
BASE	9	CIMEN5 Max	1.50	8.31	8.00	0.000	0.000	0.000
BASE	9	CIMEN5 Min	-2.75	-0.33	0.56	0.000	0.000	0.000
Summation	0, 0, Base	DEAD	0.00	0.00	53.07	183.412	-13.470	29.747
Summation	0, 0, Base	LIVE	0.00	0.00	69.47	250.655	-25.010	43.280
Summation	0, 0, Base	CIMEN1	0.00	0.00	122.55	434.067	-38.480	73.027
Summation	0, 0, Base	CIMEN2 MAX	12.86	27.25	122.57	239.492	29.172	47.439
Summation	0, 0, Base	CIMEN2 MIN	-12.86	-27.25	-16.42	127.333	-56.111	12.056
Summation	0, 0, Base	CIMEN3 MAX	12.28	23.04	118.18	297.745	61.126	24.435
Summation	0, 0, Base	CIMEN3 MIN	-12.28	-23.04	-12.03	69.079	-88.066	35.059
Summation	0, 0, Base	CIMEN4 MAX	9.63	20.42	157.24	413.334	-0.328	75.490
Summation	0, 0, Base	CIMEN4 MIN	-9.63	-20.42	53.11	329.472	-64.127	48.924
Summation	0, 0, Base	CIMEN5 MAX	9.19	17.26	153.94	457.124	23.693	58.198
Summation	0, 0, Base	CIMEN5 MIN	-9.19	-17.26	56.42	285.682	-88.148	66.217

## **T E T R A - Diseños Estructurales**

**Calle 19 # 9 - 50 - Oficina 907**

**Edificio DIARIO DEL OTUN**

**Tel. 24 50 18**

**Pereira - Colombia**

***FERNANDO ESCALANTE ECHEVERRI***

**Ing. Civil, M.Sc., Ph.D.**

**Matr. 25202-46529 Cund.**

**PROGRAMA - E T A B S -**

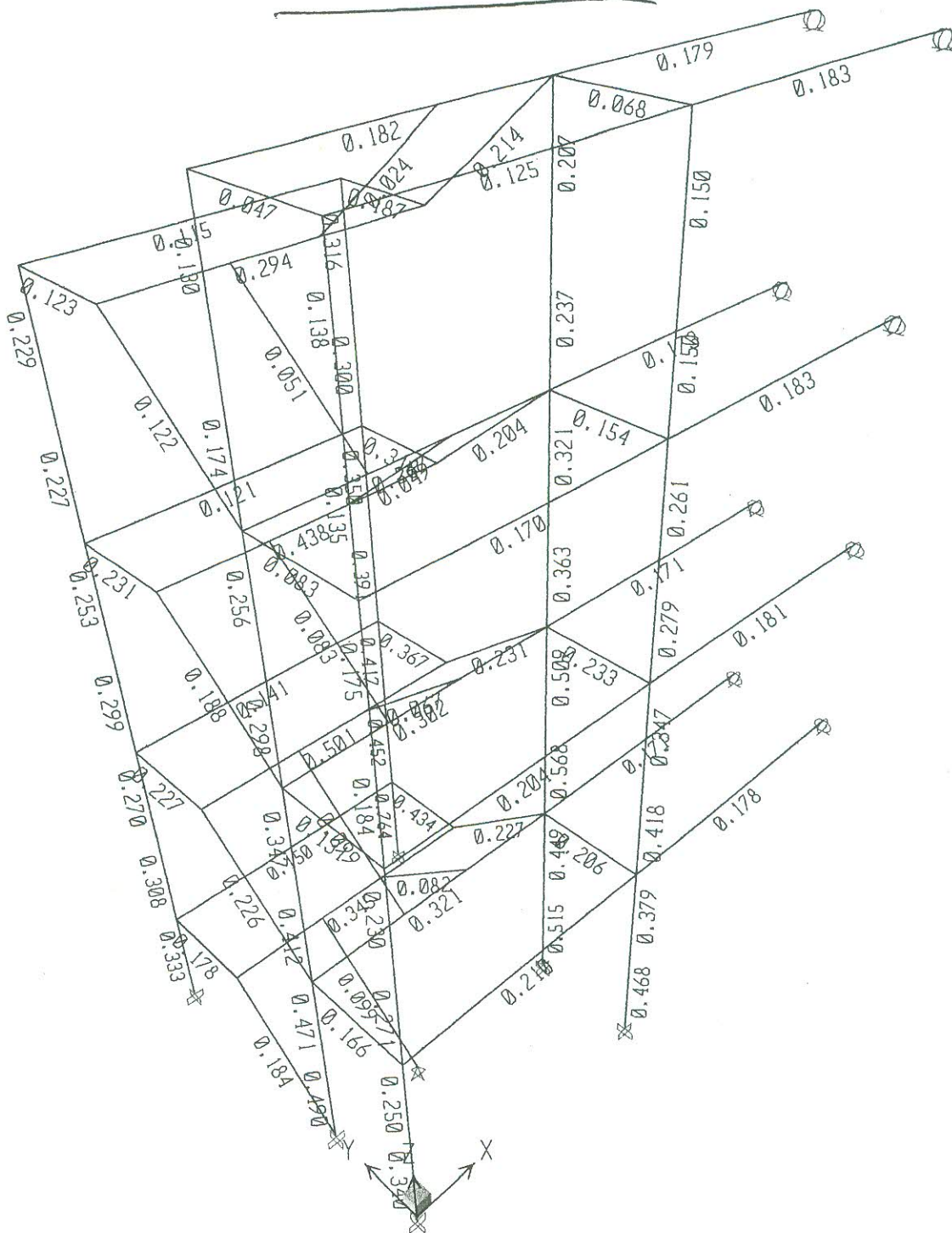
**PORTICOS TRIDIMENSIONALES**

**INDICE DE SOBRE-ESFUERZO ELEMENTOS**

---

# INDICE SOBRE ESFUERZO ELEMENTOS

35



0.

500.

700.

900.

950.

E-3

36

## **T E T R A - Diseños Estructurales**

**Calle 19 # 9 - 50 - Oficina 907**

**Edificio DIARIO DEL OTUN**

**Tel. 24 50 18**

**Pereira - Colombia**

***FERNANDO ESCALANTE ECHEVERRI***

**Ing. Civil, M.Sc., Ph.D.**

**Matr. 25202-46529 Cund.**

### **DISEÑO DE LA CIMENTACION SOBRE ZAPATAS**

# T E T R A - Diseños Estructurales

37

## ESCALERA EDIFICIO 15-B UTP - PEREIRA / Z-1

### RESISTENCIA MATERIALES:

CONCRETO: 210 kg/cm<sup>2</sup>  
ACERO: 4200 kg/cm<sup>2</sup>

CARGA MUERTA DE LA COLUMNA 23.490 ton  
CARGA VIVA DE LA COLUMNA 23.490 ton  
CARGA REAL DE LA COLUMNA 46.980 ton  
CARGA ÚLTIMA DE LA COLUMNA 72.819 ton

### TAMAÑO DE LA COLUMNA

BASE DE LA COLUMNA Bcol = 0.50 m  
ALTURA DE LA COLUMNA Hcol = 0.50 m

### TIPO DE ZAPATA

CENTRADA

### DIMENSIONES DE LA ZAPATA

LADO PARALELO A "Bcol" Bzap = 1.80 m  
LADO PARALELO A "Hcol" Hzap = 1.80 m  
ÁREA DE LA ZAPATA A = 3.24 m<sup>2</sup>  
ALTURA DE LA ZAPATA h = 0.40 m  
RECUBRIMIENTO d' = 0.07 m  
ALTURA EFECTIVA DE LA ZAPATA d = 0.33 m

### PRESIONES DE CONTACTO EN LA ZAPATA

PRESIÓN DE TRABAJO DE LA ZAPATA 14.500 ton/m<sup>2</sup>  
PRESIÓN ÚLTIMA DE LA ZAPATA 22.475 ton/m<sup>2</sup>

### ESFUERZOS CORTANTES EN LA ZAPATA

#### EN UNA DIRECCIÓN (CORTANTE)

ESFUERZO PERMITIDO: 6.528 kg/cm<sup>2</sup>  
ESFUERZO ÚLTIMO: PARALELO A "B" 2.179 kg/cm<sup>2</sup> OK  
PARALELO A "H" 2.179 kg/cm<sup>2</sup> OK

#### EN DOS DIRECCIONES (PUNZONAMIENTO):

ESFUERZO PERMITIDO 13.549 kg/cm<sup>2</sup>  
ESFUERZO ÚLTIMO 5.233 kg/cm<sup>2</sup> OK

### MOMENTOS

DIRECCIÓN PARALELA A "B" Asmin = 7.20 cm<sup>2</sup>/m  
M1 = 4.75 ton.m/m  
As1 = 7.20 cm<sup>2</sup>/m 11 # 4 @ 0.16  
DIRECCIÓN PARALELA A "H" M2 = 4.75 ton.m/m  
As2 = 7.20 cm<sup>2</sup>/m 11 # 4 @ 0.16

# T E T R A - Diseños Estructurales

## ESCALERA EDIFICIO 15-B UTP - PEREIRA / Z-2

<u>RESISTENCIA MATERIALES:</u>		CONCRETO:	210 kg/cm <sup>2</sup>	
		ACERO:	4200 kg/cm <sup>2</sup>	
CARGA MUERTA DE LA COLUMNA			16.310 ton	
CARGA VIVA DE LA COLUMNA			16.310 ton	
CARGA REAL DE LA COLUMNA			32.620 ton	
CARGA ÚLTIMA DE LA COLUMNA			50.561 ton	
<u>TAMAÑO DE LA COLUMNA</u>	BASE DE LA COLUMNA	Bcol =	0.50 m	
	ALTURA DE LA COLUMNA	Hcol =	0.50 m	
<u>TIPO DE ZAPATA</u>			CENTRADA	
<u>DIMENSIONES DE LA ZAPATA</u>				
	LADO PARALELO A "Bcol"	Bzap =	1.50 m	
	LADO PARALELO A "Hcol"	Hzap =	1.50 m	
	ÁREA DE LA ZAPATA	A =	2.25 m <sup>2</sup>	
	ALTURA DE LA ZAPATA	h =	0.40 m	
	RECUBRIMIENTO	d' =	0.07 m	
	ALTURA EFECTIVA DE LA ZAPATA	d =	0.33 m	
<u>PRESIONES DE CONTACTO EN LA ZAPATA</u>				
	PRESIÓN DE TRABAJO DE LA ZAPATA		14.498 ton/m <sup>2</sup>	
	PRESIÓN ÚLTIMA DE LA ZAPATA		22.472 ton/m <sup>2</sup>	
<u>ESFUERZOS CORTANTES EN LA ZAPATA</u>				
<u>EN UNA DIRECCIÓN (CORTANTE)</u>				
	ESFUERZO PERMITIDO:		6.528 kg/cm <sup>2</sup>	
	ESFUERZO ÚLTIMO:	PARALELO A "B"	1.158 kg/cm <sup>2</sup>	OK
		PARALELO A "H"	1.158 kg/cm <sup>2</sup>	OK
<u>EN DOS DIRECCIONES (PUNZONAMIENTO):</u>				
	ESFUERZO PERMITIDO		13.549 kg/cm <sup>2</sup>	
	ESFUERZO ÚLTIMO		3.202 kg/cm <sup>2</sup>	OK
<u>MOMENTOS</u>				
		Asmin =	7.20 cm <sup>2</sup> /m	
	DIRECCIÓN PARALELA A "B"	M1 =	2.81 ton.m/m	
		As1 =	7.20 cm <sup>2</sup> /m	9 # 4 @ 0.163
	DIRECCIÓN PARALELA A "H"	M2 =	2.81 ton.m/m	
		As2 =	7.20 cm <sup>2</sup> /m	9 # 4 @ 0.163