

0	22/06/2016	L. B.	M. I. A.	BTESA	PRIMERA EMISIÓN	PE
Rev.	Fecha	Elaborado por nombre/firma	Revisado por nombre/firma	Aprobado por nombre/firma	Descripción	Estado
<div style="text-align: center;">  <p>RTVC Sistema de Medios Públicos</p> <p>TORRE 50 m</p> <p>SAN GIL –</p> <p>SANTANDER</p> </div>						
<div style="text-align: center;"> <p>EVALUACION ESTRUCTURAL</p>  <p>BTESA B R O A D T E L E C O M</p> </div>						
ESCALA SIN	FORMATO A4	REFERENCIA BTESA TAC50-SANGIL+EXT-AMZ		REFERENCIA RTVC TORRE 50+EXT-SAN GIL	HOJA 1/29	REV 0

TABLA DE CONTENIDO

1.	DESCRIPCION	3
2.	ESPECIFICACIONES	3
3.	CARGAS.....	4
4.	MATERIALES	5
5.	ANALISIS Y DISEÑO	5
6.	ANEXOS – EVALUACION ESTRUCTURAL	5

EVALUACION ESTRUCTURAL TAC50 + EXTENSION 8 m.



TORRE 50m + ext 8 m. – SAN GIL

TAC50-SANGIL+EXT 8M. -AMZ

HOJA
2 / 29

REV.
0

TORRE 50 m + EXTENSION 8 m.

EVALUACION ESTRUCTURAL Y DISEÑO DE EXTENSION 8 m.

1. DESCRIPCIÓN:

A continuación presentamos la verificación estructural de la torre auto-soportada de 50 metros, instalada en la estación San Gil (Santander), es tipo celosía de sección cuadrada, diseñada con perfiles angulares; El chequeo se hace con las cargas de antenas instaladas actualmente: tres (3) antenas panel TV quad dipole, ocho (8) antenas Moyano FM, cuatro (4) antenas UHF, cuatro (4) antenas Panel FM y tres (3) antenas MWØ 3.0 m..

A la torre actual se proyecta realizar una extension de 8 m para la instalacion de cargas futuras definidas por dieciséis (16) antenas panel (0.5x1.0 m.), según cuadro y posteriormente se verifican los elementos que requieren refuerzo en la torre existente.

2. ESPECIFICACIONES:

Carga de diseño:



TIPO / DIAMETRO	ALTURA EN TORRE	CANTIDAD
ANTENA TV-Quad Dip	49 m.	3 unid
ANTENA Moyano FM	46 m.	4 unid
ANTENA Moyano FM	44 m.	4 unid
ANTENA UHF	42 m.	4 unid
ANTENA MW Ø3.0	37 m.	1 unid
ANTENA Panel FM	33 m.	4 unid
ANTENA MW Ø3.0	14 m.	2 unid

ANTENAS NUEVAS EN EXTENSION		
ANTENA Panel (0.5X1.0 m.)	57.5 m.	4 unid
ANTENA Panel (0.5X1.0 m.)	56.5 m.	4 unid
ANTENA Panel (0.5X1.0 m.)	55.5 m.	4 unid
ANTENA Panel (0.5X1.0 m.)	54.5 m.	4 unid

Carga viva: 3 Operarios de 80 kg. c/u.

Velocidad del viento: 120 Km / h

EVALUACION ESTRUCTURAL TAC50 + EXTENSION 8 m.

		TORRE 50m + ext 8 m. – SAN GIL		
		TAC50-SANGIL+EXT 8M. -AMZ	HOJA 3 / 29	REV. 0

Materiales :- Ángulos, canales y platinas: ASTM A36 y ASTM A572

- Tornillos : ASTM A325 –G5

Galvanizado: Según norma ASTM A153 y ASTM A123

3. CARGAS:

Las cargas de diseño corresponden a acciones de gravedad y viento sobre la torre, antenas y demás accesorios, afectadas por un factor de seguridad.

3.1. Cargas de gravedad.

El peso propio de la estructura es evaluado por el programa de análisis estructural y es afectado por un factor de 1.2 para tener en cuenta los elementos redundantes, platinas, tornillos, uniones y galvanizado. El peso de las antenas y sus soportes se obtienen directamente del catálogo del fabricante.

3.2. Carga de viento:

V = Velocidad del viento: 120 Km. / hora.

Para el cálculo de las cargas viento se utiliza el NSR-10, con la siguiente expresión:

Fuerza debida al viento $F = Q_z * C_f * A_f$

En donde:

q_z = Presion de viento en daN/m²

C_f = Coeficiente de fuerza según capitulo H

A_f = Area expuesta en m²

La presión del viento q_z , está dada por:

$$q_z = Q \times (Z_v \times V)^2 \times G$$

En donde,

Q Factor de densidad del aire = 0.0048

ZV Factor de terreno.

V Velocidad de viento básica = 120 km/h

G Factor de ráfaga de viento.

Presión de viento básica 76.2 kg/m²

3.3. Viento sobre la estructura.

Se aplican en los nudos que comprenden cada panel analizado.

EVALUACION ESTRUCTURAL TAC50 + EXTENSION 8 m.



TORRE 50m + ext 8 m. – SAN GIL

TAC50-SANGIL+EXT 8M. -AMZ

HOJA
4 / 29

REV.
0

A = área del panel analizado. S / silueta.

Se plantean tres (3) hipótesis de carga de acuerdo con las especificaciones:

3.3.1.Viento Transversal:(Hipótesis C1)

Esta dada por la siguiente expresión: $F_t = C_f * P * A$

3.3.2.Viento a 45° : (Hipótesis C2)

Esta dada por la expresión: $F_{45^\circ} = 1.15 * F_t$

Se debe aplicar en cada dirección principal simultáneamente.

Adicionalmente para verificar deformaciones se tiene una hipótesis (C3) con viento de 60.Km/h

4. MATERIALES:

Acero: ASTM A36, A572

Tornillos: ASTM A394 To

Galvanización: ASTM A153 y ASTM A123



5. ANÁLISIS Y DISEÑO.

Se llevó a cabo según lo especificado en las normas EIA-222F, NSR-10 y se ejecutó mediante el programa tower.

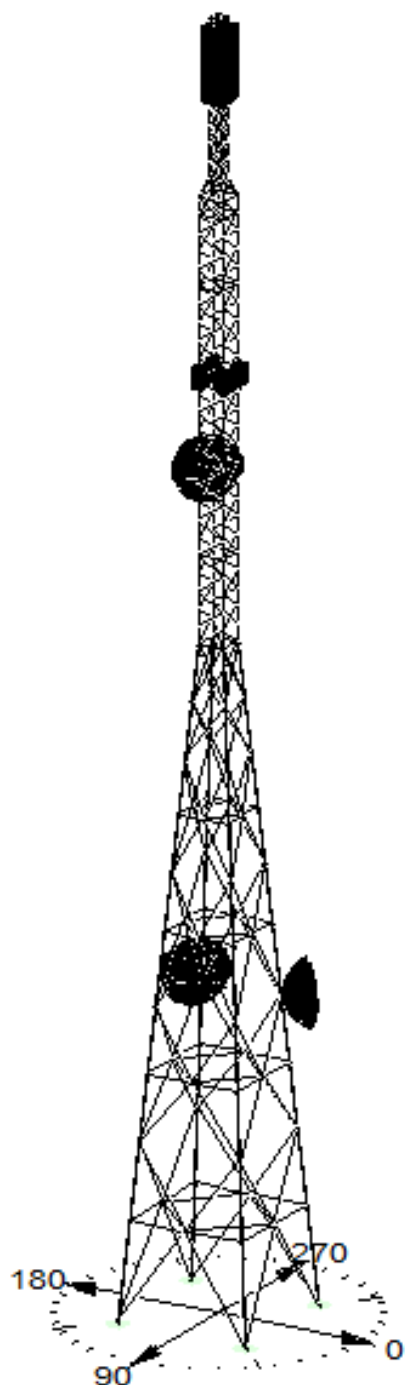
6. ANEXOS-EVALUACION ESTRUCTURAL

TORRE 50m + EXTENSION 8 m. – SAN GIL – SANTANDER

EVALUACION ESTRUCTURAL TAC50 + EXTENSION 8 m.

		TORRE 50m + ext 8 m. – SAN GIL		
		TAC50-SANGIL+EXT 8M. -AMZ	HOJA 5 / 29	REV. 0

SILUETA TAC50 + EXTENSION 8 m. -ANTENAS



EVALUACION ESTRUCTURAL TAC50 + EXTENSION 8 m.



TORRE 50m + ext 8 m. – SAN GIL

TAC50-SANGIL+EXT 8M. -AMZ

HOJA
6 / 29

REV.
0

LISTADO TOWER

 *
 * TOWER - Analysis and Design - Copyright Power Line Systems, Inc. 1986-2016 *
 *

Project Name : TORRE 50 m - SAN GIL + EXTENSION - SANTANDER -ACT.
 Project Notes: BTESA - RTVC
 Project File : c:\users\leopoldo.barrera\documents\01- ingenieria & diseNo\pls\work\j. bustos\05- evalaucion torre san gil +
 extensión\50m-120kmh+ext.tow
 Date run : 11:20:01 a.m. miércoles, 22 de junio de 2016
 by : Tower Version 14.20
 Licensed to : Ing Leopoldo Barrera - Colombia

Successfully performed linear analysis



Member check option: TIA/EIA 222-F
 Connection rupture check: Not Checked
 Crossing diagonal check: ASCE 10 [Alternate Unsupported RLOUT = 1]
 Included angle check: None
 Climbing load check: None
 Redundant members checked with: Actual Force

Joints Geometry:

Joint Label	Symmetry Code	X Coord. (m)	Y Coord. (m)	Z Coord. (m)	X Disp. Rest.	Y Disp. Rest.	Z Disp. Rest.	X Rot. Rest.	Y Rot. Rest.	Z Rot. Rest.
80P	XY-Symmetry	0.3	0.3	58	Free	Free	Free	Free	Free	Free
125P	XY-Symmetry	0.3	0.3	50.8	Free	Free	Free	Free	Free	Free
1P	XY-Symmetry	0.6	0.6	50	Free	Free	Free	Free	Free	Free
30P	XY-Symmetry	0.6	0.6	30	Free	Free	Free	Free	Free	Free
ANP	XY-Symmetry	3.09	3.09	0	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
80X	X-GenXY	0.3	-0.3	58	Free	Free	Free	Free	Free	Free
80XY	XY-GenXY	-0.3	-0.3	58	Free	Free	Free	Free	Free	Free
80Y	Y-GenXY	-0.3	0.3	58	Free	Free	Free	Free	Free	Free
125X	X-GenXY	0.3	-0.3	50.8	Free	Free	Free	Free	Free	Free
125XY	XY-GenXY	-0.3	-0.3	50.8	Free	Free	Free	Free	Free	Free
125Y	Y-GenXY	-0.3	0.3	50.8	Free	Free	Free	Free	Free	Free
1X	X-GenXY	0.6	-0.6	50	Free	Free	Free	Free	Free	Free
1XY	XY-GenXY	-0.6	-0.6	50	Free	Free	Free	Free	Free	Free
1Y	Y-GenXY	-0.6	0.6	50	Free	Free	Free	Free	Free	Free
30X	X-GenXY	0.6	-0.6	30	Free	Free	Free	Free	Free	Free
30XY	XY-GenXY	-0.6	-0.6	30	Free	Free	Free	Free	Free	Free
30Y	Y-GenXY	-0.6	0.6	30	Free	Free	Free	Free	Free	Free
ANX	X-GenXY	3.09	-3.09	0	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
ANXY	XY-GenXY	-3.09	-3.09	0	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
ANY	Y-GenXY	-3.09	3.09	0	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed

EVALUACION ESTRUCTURAL TAC50 + EXTENSION 8 m.



TORRE 50m + ext 8 m. - SAN GIL

TAC50-SANGIL+EXT 8M. -AMZ

HOJA
7 / 29

REV.
0

Secondary Joints:

Joint Label	Symmetry Code	Origin Joint	End Joint	Fraction	Elevation	X Rest.	Y Rest.	Z Rest.	X Rot.	Y Rot.	Z Rot.
(m)											
85S	XY-Symmetry	80P	125P	0	57.2	Free	Free	Free	Free	Free	Free
90S	XY-Symmetry	80P	125P	0	56.4	Free	Free	Free	Free	Free	Free
95S	XY-Symmetry	80P	125P	0	55.6	Free	Free	Free	Free	Free	Free
100S	XY-Symmetry	80P	125P	0	54.8	Free	Free	Free	Free	Free	Free
105S	XY-Symmetry	80P	125P	0	54	Free	Free	Free	Free	Free	Free
110S	XY-Symmetry	80P	125P	0	53.2	Free	Free	Free	Free	Free	Free
115S	XY-Symmetry	80P	125P	0	52.4	Free	Free	Free	Free	Free	Free
120S	XY-Symmetry	80P	125P	0	51.6	Free	Free	Free	Free	Free	Free
2S	XY-Symmetry	1P	30P	0	49.2	Free	Free	Free	Free	Free	Free
3S	XY-Symmetry	1P	30P	0	48.4	Free	Free	Free	Free	Free	Free
4S	XY-Symmetry	1P	30P	0	47.6	Free	Free	Free	Free	Free	Free
5S	XY-Symmetry	1P	30P	0	46.8	Free	Free	Free	Free	Free	Free
6S	XY-Symmetry	1P	30P	0	46	Free	Free	Free	Free	Free	Free
7S	XY-Symmetry	1P	30P	0	45.2	Free	Free	Free	Free	Free	Free
8S	XY-Symmetry	1P	30P	0	44.4	Free	Free	Free	Free	Free	Free
9S	XY-Symmetry	1P	30P	0	43.6	Free	Free	Free	Free	Free	Free
10S	XY-Symmetry	1P	30P	0	42.8	Free	Free	Free	Free	Free	Free
11S	XY-Symmetry	1P	30P	0	42	Free	Free	Free	Free	Free	Free
12S	XY-Symmetry	1P	30P	0	41.2	Free	Free	Free	Free	Free	Free
13S	XY-Symmetry	1P	30P	0	40.4	Free	Free	Free	Free	Free	Free
14S	XY-Symmetry	1P	30P	0	39.6	Free	Free	Free	Free	Free	Free
15S	XY-Symmetry	1P	30P	0	38.8	Free	Free	Free	Free	Free	Free
16S	XY-Symmetry	1P	30P	0	38	Free	Free	Free	Free	Free	Free
17S	XY-Symmetry	1P	30P	0	37.2	Free	Free	Free	Free	Free	Free
18S	XY-Symmetry	1P	30P	0	36.4	Free	Free	Free	Free	Free	Free
19S	XY-Symmetry	1P	30P	0	35.6	Free	Free	Free	Free	Free	Free
20S	XY-Symmetry	1P	30P	0	34.8	Free	Free	Free	Free	Free	Free
21S	XY-Symmetry	1P	30P	0	34	Free	Free	Free	Free	Free	Free
22S	XY-Symmetry	1P	30P	0	33.2	Free	Free	Free	Free	Free	Free
23S	XY-Symmetry	1P	30P	0	32.4	Free	Free	Free	Free	Free	Free
24S	XY-Symmetry	1P	30P	0	31.6	Free	Free	Free	Free	Free	Free
25S	XY-Symmetry	1P	30P	0	30.8	Free	Free	Free	Free	Free	Free
35S	XY-Symmetry	30P	ANP	0	27.5	Free	Free	Free	Free	Free	Free
40S	XY-Symmetry	30P	ANP	0	25	Free	Free	Free	Free	Free	Free
45S	XY-Symmetry	30P	ANP	0	22.5	Free	Free	Free	Free	Free	Free
46S	None	45X	45XY	0.5	0	Free	Free	Free	Free	Free	Free
47S	None	45XY	45Y	0.5	0	Free	Free	Free	Free	Free	Free
48S	None	45Y	45S	0.5	0	Free	Free	Free	Free	Free	Free
49S	None	45S	45X	0.5	0	Free	Free	Free	Free	Free	Free
50S	XY-Symmetry	30P	ANP	0	20	Free	Free	Free	Free	Free	Free
55S	XY-Symmetry	30P	ANP	0	17.3	Free	Free	Free	Free	Free	Free
56S	None	55X	55XY	0.5	0	Free	Free	Free	Free	Free	Free
57S	None	55XY	55Y	0.5	0	Free	Free	Free	Free	Free	Free
58S	None	55Y	55S	0.5	0	Free	Free	Free	Free	Free	Free
59S	None	55S	55X	0.5	0	Free	Free	Free	Free	Free	Free
60S	XY-Symmetry	30P	ANP	0	14	Free	Free	Free	Free	Free	Free
65S	XY-Symmetry	30P	ANP	0	11	Free	Free	Free	Free	Free	Free
66S	None	65X	65XY	0.5	0	Free	Free	Free	Free	Free	Free
67S	None	65XY	65Y	0.5	0	Free	Free	Free	Free	Free	Free
68S	None	65Y	65S	0.5	0	Free	Free	Free	Free	Free	Free
69S	None	65S	65X	0.5	0	Free	Free	Free	Free	Free	Free
70S	XY-Symmetry	30P	ANP	0	8	Free	Free	Free	Free	Free	Free
75S	XY-Symmetry	30P	ANP	0	4.5	Free	Free	Free	Free	Free	Free
76S	None	75X	75XY	0.5	0	Free	Free	Free	Free	Free	Free
77S	None	75XY	75Y	0.5	0	Free	Free	Free	Free	Free	Free
78S	None	75Y	75S	0.5	0	Free	Free	Free	Free	Free	Free
79S	None	75S	75X	0.5	0	Free	Free	Free	Free	Free	Free
85X	X-GenXY	80P	125P	0	57.2	Free	Free	Free	Free	Free	Free
85XY	XY-GenXY	80P	125P	0	57.2	Free	Free	Free	Free	Free	Free
85Y	Y-GenXY	80P	125P	0	57.2	Free	Free	Free	Free	Free	Free
90X	X-GenXY	80P	125P	0	56.4	Free	Free	Free	Free	Free	Free
90XY	XY-GenXY	80P	125P	0	56.4	Free	Free	Free	Free	Free	Free
90Y	Y-GenXY	80P	125P	0	56.4	Free	Free	Free	Free	Free	Free
95X	X-GenXY	80P	125P	0	55.6	Free	Free	Free	Free	Free	Free
95XY	XY-GenXY	80P	125P	0	55.6	Free	Free	Free	Free	Free	Free
95Y	Y-GenXY	80P	125P	0	55.6	Free	Free	Free	Free	Free	Free
100X	X-GenXY	80P	125P	0	54.8	Free	Free	Free	Free	Free	Free
100XY	XY-GenXY	80P	125P	0	54.8	Free	Free	Free	Free	Free	Free
100Y	Y-GenXY	80P	125P	0	54.8	Free	Free	Free	Free	Free	Free
105X	X-GenXY	80P	125P	0	54	Free	Free	Free	Free	Free	Free
105XY	XY-GenXY	80P	125P	0	54	Free	Free	Free	Free	Free	Free
105Y	Y-GenXY	80P	125P	0	54	Free	Free	Free	Free	Free	Free
110X	X-GenXY	80P	125P	0	53.2	Free	Free	Free	Free	Free	Free
110XY	XY-GenXY	80P	125P	0	53.2	Free	Free	Free	Free	Free	Free
110Y	Y-GenXY	80P	125P	0	53.2	Free	Free	Free	Free	Free	Free
115X	X-GenXY	80P	125P	0	52.4	Free	Free	Free	Free	Free	Free
115XY	XY-GenXY	80P	125P	0	52.4	Free	Free	Free	Free	Free	Free
115Y	Y-GenXY	80P	125P	0	52.4	Free	Free	Free	Free	Free	Free
120X	X-GenXY	80P	125P	0	51.6	Free	Free	Free	Free	Free	Free
120XY	XY-GenXY	80P	125P	0	51.6	Free	Free	Free	Free	Free	Free
120Y	Y-GenXY	80P	125P	0	51.6	Free	Free	Free	Free	Free	Free

EVALUACION ESTRUCTURAL TAC50 + EXTENSION 8 m.



TORRE 50m + ext 8 m. – SAN GIL

TAC50-SANGIL+EXT 8M. -AMZ

HOJA
8 / 29

REV.
0

2X	X-GenXY	1P	30P	0	49.2	Free	Free	Free	Free	Free	Free
2XY	XY-GenXY	1P	30P	0	49.2	Free	Free	Free	Free	Free	Free
2Y	Y-GenXY	1P	30P	0	49.2	Free	Free	Free	Free	Free	Free
3X	X-GenXY	1P	30P	0	48.4	Free	Free	Free	Free	Free	Free
3XY	XY-GenXY	1P	30P	0	48.4	Free	Free	Free	Free	Free	Free
3Y	Y-GenXY	1P	30P	0	48.4	Free	Free	Free	Free	Free	Free
4X	X-GenXY	1P	30P	0	47.6	Free	Free	Free	Free	Free	Free
4XY	XY-GenXY	1P	30P	0	47.6	Free	Free	Free	Free	Free	Free
4Y	Y-GenXY	1P	30P	0	47.6	Free	Free	Free	Free	Free	Free
5X	X-GenXY	1P	30P	0	46.8	Free	Free	Free	Free	Free	Free
5XY	XY-GenXY	1P	30P	0	46.8	Free	Free	Free	Free	Free	Free
5Y	Y-GenXY	1P	30P	0	46.8	Free	Free	Free	Free	Free	Free
6X	X-GenXY	1P	30P	0	46	Free	Free	Free	Free	Free	Free
6XY	XY-GenXY	1P	30P	0	46	Free	Free	Free	Free	Free	Free
6Y	Y-GenXY	1P	30P	0	46	Free	Free	Free	Free	Free	Free
7X	X-GenXY	1P	30P	0	45.2	Free	Free	Free	Free	Free	Free
7XY	XY-GenXY	1P	30P	0	45.2	Free	Free	Free	Free	Free	Free
7Y	Y-GenXY	1P	30P	0	45.2	Free	Free	Free	Free	Free	Free
8X	X-GenXY	1P	30P	0	44.4	Free	Free	Free	Free	Free	Free
8XY	XY-GenXY	1P	30P	0	44.4	Free	Free	Free	Free	Free	Free
8Y	Y-GenXY	1P	30P	0	44.4	Free	Free	Free	Free	Free	Free
9X	X-GenXY	1P	30P	0	43.6	Free	Free	Free	Free	Free	Free
9XY	XY-GenXY	1P	30P	0	43.6	Free	Free	Free	Free	Free	Free
9Y	Y-GenXY	1P	30P	0	43.6	Free	Free	Free	Free	Free	Free
10X	X-GenXY	1P	30P	0	42.8	Free	Free	Free	Free	Free	Free
10XY	XY-GenXY	1P	30P	0	42.8	Free	Free	Free	Free	Free	Free
10Y	Y-GenXY	1P	30P	0	42.8	Free	Free	Free	Free	Free	Free
11X	X-GenXY	1P	30P	0	42	Free	Free	Free	Free	Free	Free
11XY	XY-GenXY	1P	30P	0	42	Free	Free	Free	Free	Free	Free
11Y	Y-GenXY	1P	30P	0	42	Free	Free	Free	Free	Free	Free
12X	X-GenXY	1P	30P	0	41.2	Free	Free	Free	Free	Free	Free
12XY	XY-GenXY	1P	30P	0	41.2	Free	Free	Free	Free	Free	Free
12Y	Y-GenXY	1P	30P	0	41.2	Free	Free	Free	Free	Free	Free
13X	X-GenXY	1P	30P	0	40.4	Free	Free	Free	Free	Free	Free
13XY	XY-GenXY	1P	30P	0	40.4	Free	Free	Free	Free	Free	Free
13Y	Y-GenXY	1P	30P	0	40.4	Free	Free	Free	Free	Free	Free
14X	X-GenXY	1P	30P	0	39.6	Free	Free	Free	Free	Free	Free
14XY	XY-GenXY	1P	30P	0	39.6	Free	Free	Free	Free	Free	Free
14Y	Y-GenXY	1P	30P	0	39.6	Free	Free	Free	Free	Free	Free
15X	X-GenXY	1P	30P	0	38.8	Free	Free	Free	Free	Free	Free
15XY	XY-GenXY	1P	30P	0	38.8	Free	Free	Free	Free	Free	Free
15Y	Y-GenXY	1P	30P	0	38.8	Free	Free	Free	Free	Free	Free
16X	X-GenXY	1P	30P	0	38	Free	Free	Free	Free	Free	Free
16XY	XY-GenXY	1P	30P	0	38	Free	Free	Free	Free	Free	Free
16Y	Y-GenXY	1P	30P	0	38	Free	Free	Free	Free	Free	Free
17X	X-GenXY	1P	30P	0	37.2	Free	Free	Free	Free	Free	Free
17XY	XY-GenXY	1P	30P	0	37.2	Free	Free	Free	Free	Free	Free
17Y	Y-GenXY	1P	30P	0	37.2	Free	Free	Free	Free	Free	Free
18X	X-GenXY	1P	30P	0	36.4	Free	Free	Free	Free	Free	Free
18XY	XY-GenXY	1P	30P	0	36.4	Free	Free	Free	Free	Free	Free
18Y	Y-GenXY	1P	30P	0	36.4	Free	Free	Free	Free	Free	Free
19X	X-GenXY	1P	30P	0	35.6	Free	Free	Free	Free	Free	Free
19XY	XY-GenXY	1P	30P	0	35.6	Free	Free	Free	Free	Free	Free
19Y	Y-GenXY	1P	30P	0	35.6	Free	Free	Free	Free	Free	Free
20X	X-GenXY	1P	30P	0	34.8	Free	Free	Free	Free	Free	Free
20XY	XY-GenXY	1P	30P	0	34.8	Free	Free	Free	Free	Free	Free
20Y	Y-GenXY	1P	30P	0	34.8	Free	Free	Free	Free	Free	Free
21X	X-GenXY	1P	30P	0	34	Free	Free	Free	Free	Free	Free
21XY	XY-GenXY	1P	30P	0	34	Free	Free	Free	Free	Free	Free
21Y	Y-GenXY	1P	30P	0	34	Free	Free	Free	Free	Free	Free
22X	X-GenXY	1P	30P	0	33.2	Free	Free	Free	Free	Free	Free
22XY	XY-GenXY	1P	30P	0	33.2	Free	Free	Free	Free	Free	Free
22Y	Y-GenXY	1P	30P	0	33.2	Free	Free	Free	Free	Free	Free
23X	X-GenXY	1P	30P	0	32.4	Free	Free	Free	Free	Free	Free
23XY	XY-GenXY	1P	30P	0	32.4	Free	Free	Free	Free	Free	Free
23Y	Y-GenXY	1P	30P	0	32.4	Free	Free	Free	Free	Free	Free
24X	X-GenXY	1P	30P	0	31.6	Free	Free	Free	Free	Free	Free
24XY	XY-GenXY	1P	30P	0	31.6	Free	Free	Free	Free	Free	Free
24Y	Y-GenXY	1P	30P	0	31.6	Free	Free	Free	Free	Free	Free
25X	X-GenXY	1P	30P	0	30.8	Free	Free	Free	Free	Free	Free
25XY	XY-GenXY	1P	30P	0	30.8	Free	Free	Free	Free	Free	Free
25Y	Y-GenXY	1P	30P	0	30.8	Free	Free	Free	Free	Free	Free
35X	X-GenXY	30P	ANP	0	27.5	Free	Free	Free	Free	Free	Free
35XY	XY-GenXY	30P	ANP	0	27.5	Free	Free	Free	Free	Free	Free
35Y	Y-GenXY	30P	ANP	0	27.5	Free	Free	Free	Free	Free	Free
40X	X-GenXY	30P	ANP	0	25	Free	Free	Free	Free	Free	Free
40XY	XY-GenXY	30P	ANP	0	25	Free	Free	Free	Free	Free	Free
40Y	Y-GenXY	30P	ANP	0	25	Free	Free	Free	Free	Free	Free
45X	X-GenXY	30P	ANP	0	22.5	Free	Free	Free	Free	Free	Free
45XY	XY-GenXY	30P	ANP	0	22.5	Free	Free	Free	Free	Free	Free
45Y	Y-GenXY	30P	ANP	0	22.5	Free	Free	Free	Free	Free	Free
50X	X-GenXY	30P	ANP	0	20	Free	Free	Free	Free	Free	Free
50XY	XY-GenXY	30P	ANP	0	20	Free	Free	Free	Free	Free	Free
50Y	Y-GenXY	30P	ANP	0	20	Free	Free	Free	Free	Free	Free

EVALUACION ESTRUCTURAL TAC50 + EXTENSION 8 m.



TORRE 50m + ext 8 m. – SAN GIL

TAC50-SANGIL+EXT 8M. -AMZ

HOJA
9 / 29

REV.
0

55X	X-GenXY	30P	ANP	0	17.3	Free	Free	Free	Free	Free	Free
55XY	XY-GenXY	30P	ANP	0	17.3	Free	Free	Free	Free	Free	Free
55Y	Y-GenXY	30P	ANP	0	17.3	Free	Free	Free	Free	Free	Free
60X	X-GenXY	30P	ANP	0	14	Free	Free	Free	Free	Free	Free
60XY	XY-GenXY	30P	ANP	0	14	Free	Free	Free	Free	Free	Free
60Y	Y-GenXY	30P	ANP	0	14	Free	Free	Free	Free	Free	Free
65X	X-GenXY	30P	ANP	0	11	Free	Free	Free	Free	Free	Free
65XY	XY-GenXY	30P	ANP	0	11	Free	Free	Free	Free	Free	Free
65Y	Y-GenXY	30P	ANP	0	11	Free	Free	Free	Free	Free	Free
70X	X-GenXY	30P	ANP	0	8	Free	Free	Free	Free	Free	Free
70XY	XY-GenXY	30P	ANP	0	8	Free	Free	Free	Free	Free	Free
70Y	Y-GenXY	30P	ANP	0	8	Free	Free	Free	Free	Free	Free
75X	X-GenXY	30P	ANP	0	4.5	Free	Free	Free	Free	Free	Free
75XY	XY-GenXY	30P	ANP	0	4.5	Free	Free	Free	Free	Free	Free
75Y	Y-GenXY	30P	ANP	0	4.5	Free	Free	Free	Free	Free	Free

The model contains 20 primary and 180 secondary joints for a total of 200 joints.

Steel Material Properties:

Steel Material Label	Modulus of Elasticity (MPa)	Yield Stress (MPa)	Ultimate Stress (MPa)	Member All. Stress (MPa)	Member All. Stress Hyp. 1 (MPa)	Member Rupture Stress Hyp. 2 (MPa)	Member Rupture Stress Hyp. 1 (MPa)	Member Rupture Stress Hyp. 2 (MPa)	Member Bearing Stress Hyp. 1 (MPa)	Member Bearing Stress Hyp. 2 (MPa)
A572-50	1.999e+005	344.7	448.2	0	0	0	0	0	0	0

Bolt Properties:

Bolt Label	Bolt Diameter (cm)	Hole Diameter (cm)	Ultimate Shear Capacity (kN)	Default End Distance (cm)	Default Bolt Spacing (cm)	Shear Capacity Hyp. 1 (kN)	Shear Capacity Hyp. 2 (kN)
5/8 A394 TYPE0 X	1.587	1.746	62.72	0	0	0	0

Number Bolts Used By Type:

Bolt Type	Number Bolts
5/8 A394 TYPE0 X	1356

Angle Properties:

Angle Type	Angle Size	Long Leg (cm)	Short Leg (cm)	Thick. (cm)	Unit Weight (N/m)	Gross Area (cm ²)	w/t Ratio	Radius of Gyration Rx (cm)	Radius of Gyration Ry (cm)	Radius of Gyration Rz (cm)	Number of Angles	Wind Width (cm)	Short Edge Dist. (cm)	Long Edge Dist. (cm)	Optimize Cost Factor	Section Modulus (cm ³)
SAE	6X6X0.625	15.24	15.24	1.587	353.2	45.87	7.8	4.674	4.674	2.997	1	15.24	0	0	1.0000	0
SAE	4X4X0.375	10.16	10.16	0.9525	143	18.45	8.67	3.124	3.124	2.002	1	10.16	0	0	1.0000	0
SAE	3X3X0.3125	7.62	7.62	0.7937	89.02	11.48	7.6	2.342	2.342	1.496	1	7.62	0	0	1.0000	0
SAE	3X3X0.25	7.62	7.62	0.635	71.51	9.29	9.75	2.362	2.362	1.504	1	7.62	0	0	1.0000	0
SAE	2.5X2.5X0.25	6.35	6.35	0.635	59.84	7.677	7.75	1.953	1.953	1.247	1	6.35	0	0	1.0000	0
SAE	2.5X2.5X0.1875	6.35	6.35	0.4763	44.8	5.819	10.67	1.976	1.976	1.257	1	6.35	0	0	1.0000	0
SAE	2X2X0.1875	5.08	5.08	0.4763	35.61	4.581	8	1.567	1.567	1.001	1	5.08	0	0	1.0000	0

Angle Groups:

Group Label	Group Description	Angle Type	Angle Size	Material Type	Element Type	Group Type	Optimize Group	Allow. Angle Width (cm)	Add. Width For Optimize (cm)
M0	M0	SAE	2.5X2.5X0.25	A572-50	Beam	Leg	Size + Type	30.480	
M1A	M1A	SAE	2.5X2.5X0.25	A572-50	Beam	Leg	Size + Type	30.480	
M1	M1	SAE	2.5X2.5X0.25	A572-50	Beam	Leg	Size + Type	30.480	
M2	M2	SAE	3X3X0.3125	A572-50	Beam	Leg	Size + Type	30.480	
M3	M3	SAE	4X4X0.375	A572-50	Beam	Leg	Size + Type	30.480	
M4	M4	SAE	4X4X0.375	A572-50	Beam	Leg	Size + Type	30.480	
M5	M5	SAE	4X4X0.375	A572-50	Beam	Leg	Size + Type	30.480	
M6	M6	SAE	6X6X0.625	A572-50	Beam	Leg	Size + Type	30.480	
M7	M7	SAE	6X6X0.625	A572-50	Beam	Leg	Size + Type	30.480	
M8	M8	SAE	6X6X0.625	A572-50	Beam	Leg	Size + Type	30.480	
M9	M9	SAE	6X6X0.625	A572-50	Beam	Leg	Size + Type	30.480	
M10	M10	SAE	6X6X0.625	A572-50	Beam	Leg	Size + Type	30.480	
M11	M11	SAE	6X6X0.625	A572-50	Beam	Leg	Size + Type	30.480	
D1	D1	SAE	2X2X0.1875	A572-50	Truss		Size + Type	30.480	
D2	D2	SAE	2X2X0.1875	A572-50	Truss		Size + Type	30.480	
D3	D3	SAE	2X2X0.1875	A572-50	Truss		Size + Type	30.480	
D4	D4	SAE	2X2X0.1875	A572-50	Truss		Size + Type	30.480	
D5	D5	SAE	2X2X0.1875	A572-50	Truss		Size + Type	30.480	
D6	D6	SAE	2X2X0.1875	A572-50	Truss		Size + Type	30.480	

EVALUACION ESTRUCTURAL TAC50 + EXTENSION 8 m.



TORRE 50m + ext 8 m. – SAN GIL

TAC50-SANGIL+EXT 8M. -AMZ

HOJA
10 / 29

REV.
0

D7	D7	SAE	2X2X0.1875	A572-50	Truss	Size + Type	30.480
D8	D8	SAE	2X2X0.1875	A572-50	Truss	Size + Type	30.480
D9	D9	SAE	2X2X0.1875	A572-50	Truss	Size + Type	30.480
D10	D10	SAE	2X2X0.1875	A572-50	Truss	Size + Type	30.480
D11	D11	SAE	2X2X0.1875	A572-50	Truss	Size + Type	30.480
D12	D12	SAE	2X2X0.1875	A572-50	Truss	Size + Type	30.480
D13	D13	SAE	2X2X0.1875	A572-50	Truss	Size + Type	30.480
D14	D14	SAE	2X2X0.1875	A572-50	Truss	Size + Type	30.480
D15	D15	SAE	2X2X0.1875	A572-50	Truss	Size + Type	30.480
D16	D16	SAE	2.5X2.5X0.1875	A572-50	Truss	Size + Type	30.480
D17	D17	SAE	2.5X2.5X0.1875	A572-50	Truss	Size + Type	30.480
D18	D18	SAE	2.5X2.5X0.1875	A572-50	Truss	Size + Type	30.480
D19	D19	SAE	2.5X2.5X0.1875	A572-50	Truss	Size + Type	30.480
D20	D20	SAE	2.5X2.5X0.1875	A572-50	Truss	Size + Type	30.480
D21	D21	SAE	2.5X2.5X0.1875	A572-50	Truss	Size + Type	30.480
D22	D22	SAE	2.5X2.5X0.1875	A572-50	Truss	Size + Type	30.480
D23	D23	SAE	2.5X2.5X0.1875	A572-50	Truss	Size + Type	30.480
D24	D24	SAE	2.5X2.5X0.1875	A572-50	Truss	Size + Type	30.480
D25	D25	SAE	2.5X2.5X0.1875	A572-50	Truss	Size + Type	30.480
D26	D26	SAE	2X2X0.1875	A572-50	Truss	Size + Type	30.480
D27	D27	SAE	2X2X0.1875	A572-50	Truss	Size + Type	30.480
D28	D28	SAE	2.5X2.5X0.25	A572-50	Truss	Size + Type	30.480
D29	D29	SAE	2.5X2.5X0.25	A572-50	Truss	Size + Type	30.480
D30	D30	SAE	3X3X0.25	A572-50	Truss	Size + Type	30.480
D31	D31	SAE	3X3X0.25	A572-50	Truss	Size + Type	30.480
D32	D32	SAE	3X3X0.25	A572-50	Truss	Size + Type	30.480
D33	D33	SAE	3X3X0.3125	A572-50	Truss	Size + Type	30.480
D34	D34	SAE	3X3X0.3125	A572-50	Truss	Size + Type	30.480
D35	D35	SAE	2.5X2.5X0.25	A572-50	Truss	Size + Type	30.480
D36	D36	SAE	2X2X0.1875	A572-50	Truss	Size + Type	30.480
D37	D37	SAE	2X2X0.1875	A572-50	Truss	Size + Type	30.480
D38	D38	SAE	2X2X0.1875	A572-50	Truss	Size + Type	30.480
D39	D39	SAE	2X2X0.1875	A572-50	Truss	Size + Type	30.480
D40	D40	SAE	2X2X0.1875	A572-50	Truss	Size + Type	30.480
D41	D41	SAE	2X2X0.1875	A572-50	Truss	Size + Type	30.480
D42	D42	SAE	2X2X0.1875	A572-50	Truss	Size + Type	30.480
D43	D43	SAE	2X2X0.1875	A572-50	Truss	Size + Type	30.480
D44	D44	SAE	2X2X0.1875	A572-50	Truss	Size + Type	30.480
D45	D45	SAE	2X2X0.1875	A572-50	Truss	Size + Type	30.480
H1	H1	SAE	2X2X0.1875	A572-50	Truss	Size + Type	30.480
H2	H2	SAE	2X2X0.1875	A572-50	Truss	Size + Type	30.480
H3	H3	SAE	2X2X0.1875	A572-50	Truss	Size + Type	30.480
H4	H4	SAE	2X2X0.1875	A572-50	Truss	Size + Type	30.480
H5	H5	SAE	2.5X2.5X0.1875	A572-50	Truss	Size + Type	30.480
H6	H6	SAE	2.5X2.5X0.1875	A572-50	Truss	Size + Type	30.480
H7	H7	SAE	2.5X2.5X0.1875	A572-50	Truss	Size + Type	30.480
H8	H8	SAE	2.5X2.5X0.1875	A572-50	Truss	Size + Type	30.480
H9	H9	SAE	2.5X2.5X0.1875	A572-50	Truss	Size + Type	30.480
H10	H10	SAE	2.5X2.5X0.1875	A572-50	Truss	Size + Type	30.480
H11	H11	SAE	2.5X2.5X0.1875	A572-50	Truss	Size + Type	30.480
H12	H12	SAE	2X2X0.1875	A572-50	Truss	Size + Type	30.480
H13	H13	SAE	2X2X0.1875	A572-50	Truss	Size + Type	30.480
H14	H14	SAE	2X2X0.1875	A572-50	Truss	Size + Type	30.480
C1	C1	SAE	2.5X2.5X0.1875	A572-50	Truss	Size + Type	30.480
C2	C2	SAE	2.5X2.5X0.1875	A572-50	Truss	Size + Type	30.480
C3	C3	SAE	2.5X2.5X0.1875	A572-50	Truss	Size + Type	30.480
C4	C4	SAE	2.5X2.5X0.1875	A572-50	Truss	Size + Type	30.480

Aggregate Angle Information:

Note: Estimate of surface area reported for painting purposes, not wind loading.

Angle Type	Angle Size	Material Type	Total Length (m)	Total Surface Area (m^2)	Total Weight (N)
SAE	2.5X2.5X0.25	A572-50	136.94	34.78	8194.05
SAE	3X3X0.3125	A572-50	81.08	24.71	7217.73
SAE	4X4X0.375	A572-50	48.00	19.51	6864.96
SAE	6X6X0.625	A572-50	120.82	73.65	42671.60
SAE	2X2X0.1875	A572-50	242.68	49.31	8641.57
SAE	2.5X2.5X0.1875	A572-50	179.07	45.48	8023.01
SAE	3X3X0.25	A572-50	83.76	25.53	5989.71

EVALUACION ESTRUCTURAL TAC50 + EXTENSION 8 m.



TORRE 50m + ext 8 m. – SAN GIL

TAC50-SANGIL+EXT 8M. -AMZ

HOJA
11 / 29

REV.
0

Sections:

The adjustment factors below only apply to dead load and wind areas that are calculated for members in the model.
They do not apply to equipment or to manually input dead load and drag areas.

Section Label	Joint Defining Section Bottom	Dead Load Adjust. Factor	Transverse Drag x Area Factor For Face	Longitudinal Drag x Area Factor For Face	Transverse Area Factor (CD From Code)	Longitudinal Area Factor (CD From Code)	Af Flat Factor For EIA Only	Ar Round Factor For EIA Only	Transverse Drag x Area Factor For All	Longitudinal Drag x Area Factor For All	SAPS Drag x Area Factor	Angle Drag x Area Factor	SAPS Round Factor	Force Solid Face
1	105S	1.500	1.000	1.000	0.000	0.000	1.025	1.000	1.000	1.000	1.000	1.000	1.000	None
2	125P	1.500	1.000	1.000	0.000	0.000	1.025	1.000	1.000	1.000	1.000	1.000	1.000	None
3	6S	1.500	1.000	1.000	0.000	0.000	1.025	1.000	1.000	1.000	1.000	1.000	1.000	None
4	11S	1.500	1.000	1.000	0.000	0.000	1.025	1.000	1.000	1.000	1.000	1.000	1.000	None
5	16S	1.500	1.000	1.000	0.000	0.000	1.025	1.000	1.000	1.000	1.000	1.000	1.000	None
6	21S	1.500	1.000	1.000	0.000	0.000	1.025	1.000	1.000	1.000	1.000	1.000	1.000	None
7	30P	1.500	1.000	1.000	0.000	0.000	1.025	1.000	1.000	1.000	1.000	1.000	1.000	None
8	40S	1.500	1.000	1.000	0.000	0.000	1.050	1.000	1.000	1.000	1.000	1.000	1.000	None
9	50S	1.500	1.000	1.000	0.000	0.000	1.100	1.000	1.000	1.000	1.000	1.000	1.000	None
10	60S	1.500	1.000	1.000	0.000	0.000	1.100	1.000	1.000	1.000	1.000	1.000	1.000	None
11	70S	1.500	1.000	1.000	0.000	0.000	1.100	1.000	1.000	1.000	1.000	1.000	1.000	None
12	75S	1.500	1.000	1.000	0.000	0.000	1.125	1.000	1.000	1.000	1.000	1.000	1.000	None
13	ANP	1.500	1.000	1.000	0.000	0.000	1.125	1.000	1.000	1.000	1.000	1.000	1.000	None

CARGAS APLICADAS

*** Loads Data

Loads from file: c:\users\leopoldo.barrera\documents\01- ingenieria & diseNo\pls\work\j. bustos\05- evalaucion torre san gil + extensión\50m-120kmh-act.eia

Structure Height Summary (used for calculating wind/ice adjust with height):

Structure height above ground 58.00 (m)
Elevation of structure bottom for wind height adjustment: 0.00 (m)
Structure height for structure gust response factor: 58.00 (m)
Structure gust response factor, Gh: 1.1171
Guy installation temperature: 22.00 (deg C)
Tower Type: Rectangular Latticed

EIA Rev. F Load Cases:

Load Case Description	Dead Load Factor	Wind Load Factor	Ice Load Factor	Strength Factor	Allowable Stress Increase Factor	Basic Wind Speed (m/s) (Deg)	Wind Dir. (Deg)	Ice Thick. (cm)	Ice Density (N/m^3)	Ice Temperature (deg C)	Point Loads	Joint Displ.
LC3 WIND 0°-120	1.2500	0.8500	1.0000	1.0000	1.0000	33.330	0	0.0000	0.0000	20.0	18 loads	
LC4 WIND 45°-120	1.2500	0.8500	1.0000	1.0000	1.0000	33.330	45	0.0000	0.0000	20.0	18 loads	
LC6 WIND 45°-60	1.2500	0.8500	1.0000	1.0000	1.0000	16.666	45	0.0000	0.0000	20.0	18 loads	

Concentrated Loads for Load Case "LC3 WIND 0°-120":

Joint Label	Force X-Dir (N)	Force Y-Dir (N)	Force Vertical (N)	Moment X-Axis (N-m)	Moment Y-Axis (N-m)	Moment Z-Axis (N-m)	Load Comment
2XY	1265	1265	760	0	0	0	ANTENA VHF TV 170-230MHz-Quad Dipole Panel
2S	2530	2530	760	0	0	0	ANTENA VHF TV 170-230MHz-Quad Dipole Panel
2X	2530	2530	760	0	0	0	ANTENA VHF TV 170-230MHz-Quad Dipole Panel
6Y	864	864	570	0	0	0	ANTENA MOYANO FM RADIO
6XY	864	864	570	0	0	0	ANTENA MOYANO FM RADIO
6S	864	864	570	0	0	0	ANTENA MOYANO FM RADIO
6X	864	864	570	0	0	0	ANTENA MOYANO FM RADIO
9Y	864	864	570	0	0	0	ANTENA MOYANO FM RADIO
9XY	864	864	570	0	0	0	ANTENA MOYANO FM RADIO
9S	864	864	570	0	0	0	ANTENA MOYANO FM RADIO
9X	864	864	570	0	0	0	ANTENA MOYANO FM RADIO
22Y	633	633	380	0	0	0	ANTENA PANEL FM
22XY	633	633	380	0	0	0	ANTENA PANEL FM
22S	633	633	380	0	0	0	ANTENA PANEL FM
22X	633	633	380	0	0	0	ANTENA PANEL FM
1XY	0	0	800	0	0	0	PERSONAL MANTENIMIENTO
1X	0	0	800	0	0	0	PERSONAL MANTENIMIENTO
1P	0	0	800	0	0	0	PERSONAL MANTENIMIENTO

EVALUACION ESTRUCTURAL TAC50 + EXTENSION 8 m.



TORRE 50m + ext 8 m. – SAN GIL

TAC50-SANGIL+EXT 8M. -AMZ

HOJA
12 / 29

REV.
0

Equipment Load Case Information for "LC3 WIND 0°-120°":

Equipment Label	Equipment Property Set	Elevation Above Ground (m)	qzGh (Pa)	Ice Thick. (cm)	Total Wind Area (m²)	Wind Incidence Angle (deg)	222-G CA	222-G CS	222-G CM	Antenna Load FAM (N)	Antenna Side Load FSM (N)	Antenna Moment MM (N-m)	Long. Load (N)	Trans. Load (N)	Vert. Load (N)
ANT. MW 3.0 (1)	ANTENA MW 3.048	37.20	939.61	0.00	7.30	45.00	1.62895	0.04880	-0.06130	11168.66	334.59	-1281.06	8134.03	7660.85	4925.00
ANT. MW 3.0 (2)	ANTENA MW 3.048	14.00	710.70	0.00	7.30	315.00	1.62895	-0.04880	0.06130	8447.73	-253.08	968.96	6152.40	-5794.49	4925.00
ANT. MW 3.0 (3)	ANTENA MW 3.048	14.00	710.70	0.00	7.30	45.00	1.62895	0.04880	-0.06130	8447.73	253.08	-968.96	6152.40	5794.49	4925.00
ANT. PANEL -1 ANTENA RF TIPO PANEL (0.50x1.00)		42.00	972.77	0.00	0.60	0.00							583.66	0.00	125.00
ANT. PANEL -2 ANTENA RF TIPO PANEL (0.50x1.00)		42.00	972.77	0.00	0.60	90.00							583.66	0.00	125.00
ANT. PANEL -3 ANTENA RF TIPO PANEL (0.50x1.00)		42.00	972.77	0.00	0.60	180.00							583.66	0.00	125.00
ANT. PANEL -4 ANTENA RF TIPO PANEL (0.50x1.00)		42.00	972.77	0.00	0.60	270.00							583.66	0.00	125.00
ANT. PANEL-NEW1 ANTENA RF TIPO PANEL (0.50x1.00)		57.20	1062.52	0.00	0.60	0.00							637.51	0.00	125.00
ANT. PANEL-NEW2 ANTENA RF TIPO PANEL (0.50x1.00)		57.20	1062.52	0.00	0.60	90.00							637.51	0.00	125.00
ANT. PANEL-NEW3 ANTENA RF TIPO PANEL (0.50x1.00)		57.20	1062.52	0.00	0.60	180.00							637.51	0.00	125.00
ANT. PANEL-NEW4 ANTENA RF TIPO PANEL (0.50x1.00)		57.20	1062.52	0.00	0.60	270.00							637.51	0.00	125.00
ANT. PANEL-NEW5 ANTENA RF TIPO PANEL (0.50x1.00)		56.40	1058.25	0.00	0.60	0.00							634.95	0.00	125.00
ANT. PANEL-NEW6 ANTENA RF TIPO PANEL (0.50x1.00)		56.40	1058.25	0.00	0.60	90.00							634.95	0.00	125.00
ANT. PANEL-NEW7 ANTENA RF TIPO PANEL (0.50x1.00)		56.40	1058.25	0.00	0.60	180.00							634.95	0.00	125.00
ANT. PANEL-NEW8 ANTENA RF TIPO PANEL (0.50x1.00)		56.40	1058.25	0.00	0.60	270.00							634.95	0.00	125.00
ANT. PANEL-NEW9 ANTENA RF TIPO PANEL (0.50x1.00)		55.60	1053.94	0.00	0.60	0.00							632.36	0.00	125.00
ANT. PANEL-NEW10 ANTENA RF TIPO PANEL (0.50x1.00)		55.60	1053.94	0.00	0.60	90.00							632.36	0.00	125.00
ANT. PANEL-NEW11 ANTENA RF TIPO PANEL (0.50x1.00)		55.60	1053.94	0.00	0.60	180.00							632.36	0.00	125.00
ANT. PANEL-NEW12 ANTENA RF TIPO PANEL (0.50x1.00)		55.60	1053.94	0.00	0.60	270.00							632.36	0.00	125.00
ANT. PANEL-NEW13 ANTENA RF TIPO PANEL (0.50x1.00)		54.80	1049.58	0.00	0.60	0.00							629.75	0.00	125.00
ANT. PANEL-NEW14 ANTENA RF TIPO PANEL (0.50x1.00)		54.80	1049.58	0.00	0.60	90.00							629.75	0.00	125.00
ANT. PANEL-NEW15 ANTENA RF TIPO PANEL (0.50x1.00)		54.80	1049.58	0.00	0.60	180.00							629.75	0.00	125.00
ANT. PANEL-NEW16 ANTENA RF TIPO PANEL (0.50x1.00)		54.80	1049.58	0.00	0.60	270.00							629.75	0.00	125.00

EIA Section Load Case Information for "LC3 WIND 0°-120°":

Section Label	Z of Top (m)	Z of Bottom (m)	Ave. Elev. Above Gnd. (m)	qzGh (Pa)	Ice Thick. (cm)	Face AF (m²)	Face AR (m²)	Face RR*AR (m²)	Face AG (m²)	Face e	Face DF	Face DR	Face RR	Face CF	Face AE (m²)	Face WF (N)	NotF AAF (m²)	NotF CAF	NotF AAR (m²)	NotF CAR	NotF AAR*CAR (m²)	NotF WA (N)	NotF Wind (N)	Total Weight (N)
1	58.00	54.00	56.00	1056.10	0.00	1.10	0.00	0.00	2.4	0.46	1.00	1.00	0.68	2.13	1.1	2486	0.00	2.00	0.00	1.20	0.00	0	2486	4786
2	54.00	50.80	52.40	1036.24	0.00	0.86	0.49	0.41	1.9	0.71	1.00	1.00	0.83	1.83	1.3	2410	0.06	2.00	0.00	1.20	0.00	127	2537	4359
3	50.80	46.00	48.40	1012.99	0.00	1.33	1.98	1.72	4.3	0.77	1.00	1.00	0.87	1.83	3.0	5646	0.24	2.00	0.00	1.20	0.00	496	6142	8258
4	46.00	42.00	44.00	985.78	0.00	1.06	1.65	1.21	4.8	0.56	1.00	1.00	0.73	1.94	2.3	4350	0.20	2.00	0.00	1.20	0.00	402	4752	7006
5	42.00	38.00	40.00	959.30	0.00	1.29	1.65	1.25	4.8	0.61	1.00	1.00	0.76	1.89	2.5	4601	0.20	2.00	0.00	1.20	0.00	391	4992	8708
6	38.00	34.00	36.00	930.85	0.00	1.38	1.65	1.27	4.8	0.63	1.00	1.00	0.77	1.87	2.7	4620	0.20	2.00	0.00	1.20	0.00	380	5000	9205
7	34.00	30.00	32.00	900.05	0.00	1.29	1.65	1.25	4.8	0.61	1.00	1.00	0.76	1.89	2.5	4317	0.20	2.00	0.00	1.20	0.00	367	4684	9278
8	30.00	25.00	27.50	861.91	0.00	2.25	2.06	1.47	8.1	0.53	1.00	1.00	0.72	1.99	3.7	6386	0.26	2.00	0.00	1.20	0.00	440	6826	19138
9	25.00	20.00	22.50	813.88	0.00	2.64	2.06	1.33	12.2	0.38	1.00	1.00	0.65	2.32	4.0	7505	0.26	2.00	0.00	1.20	0.00	415	7920	22369
10	20.00	14.00	17.00	751.24	0.00	3.41	2.47	1.52	20.1	0.29	1.00	1.00	0.61	2.62	4.9	9694	0.31	2.00	0.00	1.20	0.00	460	10154	28428
11	14.00	8.00	11.00	663.38	0.00	3.58	2.47	1.48	26.1	0.23	1.00	1.00	0.60	2.85	5.1	9549	0.31	2.00	0.00	1.20	0.00	406	9955	30629
12	8.00	4.50	6.25	646.64	0.00	2.33	1.44	0.85	18.0	0.21	1.00	1.00	0.59	2.94	3.2	6050	0.18	2.00	0.00	1.20	0.00	231	6280	19978
13	4.50	0.00	2.25	646.64	0.00	2.34	1.85	1.08	26.1	0.16	1.00	1.00	0.58	3.16	3.4	6974	0.23	2.00	0.00	1.20	0.00	297	7271	19262



Concentrated Loads for Load Case "LC4 WIND 45°-120°":

Joint Label	Force X-Dir (N)	Force Y-Dir (N)	Force Vertical (N)	Moment X-Axis (N-m)	Moment Y-Axis (N-m)	Moment Z-Axis (N-m)	Load Comment
2XY	1789	1789	760	0	0	0	ANTENA VHF TV 170-230MHz-Quad Dipole Panel
2S	1789	1789	760	0	0	0	ANTENA VHF TV 170-230MHz-Quad Dipole Panel
2X	1789	1789	760	0	0	0	ANTENA VHF TV 170-230MHz-Quad Dipole Panel
6Y	1221	1221	570	0	0	0	ANTENA MOYANO FM RADIO
6XY	1221	1221	570	0	0	0	ANTENA MOYANO FM RADIO
6S	1221	1221	570	0	0	0	ANTENA MOYANO FM RADIO
6X	1221	1221	570	0	0	0	ANTENA MOYANO FM RADIO
9Y	1221	1221	570	0	0	0	ANTENA MOYANO FM RADIO
9XY	1221	1221	570	0	0	0	ANTENA MOYANO FM RADIO
9S	1221	1221	570	0	0	0	ANTENA MOYANO FM RADIO
9X	1221	1221	570	0	0	0	ANTENA MOYANO FM RADIO
22Y	894	894	380	0	0	0	ANTENA PANEL FM
22XY	894	894	380	0	0	0	ANTENA PANEL FM
22S	894	894	380	0	0	0	ANTENA PANEL FM
22X	894	894	380	0	0	0	ANTENA PANEL FM
1XY	0	0	800	0	0	0	PERSONAL MANTENIMIENTO
1X	0	0	800	0	0	0	PERSONAL MANTENIMIENTO
1P	0	0	800	0	0	0	PERSONAL MANTENIMIENTO

Equipment Load Case Information for "LC4 WIND 45°-120°":

Equipment Label	Equipment Property Set	Elevation Above Ground (m)	qzGh (Pa)	Ice Thick. (cm)	Total Wind Area (m²)	Wind Incidence Angle (deg)	222-G CA	222-G CS	222-G CM	Antenna Load FAM (N)	Antenna Side Load FSM (N)	Antenna Moment MM (N-m)	Long. Load (N)	Trans. Load (N)	Vert. Load (N)
ANT. MW 3.0 (1)	ANTENA MW 3.048	37.20	939.61	0.00	7.30	360.00	1.55080	0.00000	0.00000	10632.84	0.00	0.00	7518.55	7518.55	4925.00
ANT. MW 3.0 (2)	ANTENA MW 3.048	14.00	710.70	0.00	7.30	270.00	-0.01170	-0.34380	-0.13130	-60.68	-1782.95	-2075.45	1217.83	1303.64	4925.00
ANT. MW 3.0 (3)	ANTENA MW 3.048	14.00	710.70	0.00	7.30	360.00	1.55080	0.00000	0.00000	8042.44	0.00	0.00	5686.86	5686.86	4925.00
ANT. PANEL -1 ANTENA RF TIPO PANEL (0.50x1.00)		42.00	972.77	0.00	0.60	315.00							412.71	412.71	125.00
ANT. PANEL -2 ANTENA RF TIPO PANEL (0.50x1.00)		42.00	972.77	0.00	0.60	45.00							412.71	412.71	125.00
ANT. PANEL -3 ANTENA RF TIPO PANEL (0.50x1.00)		42.00	972.77	0.00	0.60	135.00							412.71	412.71	125.00
ANT. PANEL -4 ANTENA RF TIPO PANEL (0.50x1.00)		42.00	972.77	0.00	0.60	225.00							412.71	412.71	125.00
ANT. PANEL-NEW1 ANTENA RF TIPO PANEL (0.50x1.00)		57.20	1062.52	0.00	0.60	315.00							450.79	450.79	125.00
ANT. PANEL-NEW2 ANTENA RF TIPO PANEL (0.50x1.00)		57.20	1062.52	0.00	0.60	45.00							450.79	450.79	125.00
ANT. PANEL-NEW3 ANTENA RF TIPO PANEL (0.50x1.00)		57.20	1062.52	0.00	0.60	135.00							450.79	450.79	125.00
ANT. PANEL-NEW4 ANTENA RF TIPO PANEL (0.50x1.00)		57.20	1062.52	0.00	0.60	225.00							450.79	450.79	125.00
ANT. PANEL-NEW5 ANTENA RF TIPO PANEL (0.50x1.00)		56.40	1058.25	0.00	0.60	315.00							448.98	448.98	125.00
ANT. PANEL-NEW6 ANTENA RF TIPO PANEL (0.50x1.00)		56.40	1058.25	0.00	0.60	45.00							448.98	448.98	125.00
ANT. PANEL-NEW7 ANTENA RF TIPO PANEL (0.50x1.00)		56.40	1058.25	0.00	0.60	135.00							448.98	448.98	125.00
ANT. PANEL-NEW8 ANTENA RF TIPO PANEL (0.50x1.00)		56.40	1058.25	0.00	0.60	225.00							448.98	448.98	125.00
ANT. PANEL-NEW9 ANTENA RF TIPO PANEL (0.50x1.00)		55.60	1053.94	0.00	0.60	315.00							447.15	447.15	125.00
ANT. PANEL-NEW10 ANTENA RF TIPO PANEL (0.50x1.00)		55.60	1053.94	0.00	0.60	45.00							447.15	447.15	125.00
ANT. PANEL-NEW11 ANTENA RF TIPO PANEL (0.50x1.00)		55.60	1053.94	0.00	0.60	135.00							447.15	447.15	125.00
ANT. PANEL-NEW12 ANTENA RF TIPO PANEL (0.50x1.00)		55.60	1053.94	0.00	0.60	225.00							447.15	447.15	125.00
ANT. PANEL-NEW13 ANTENA RF TIPO PANEL (0.50x1.00)		54.80	1049.58	0.00	0.60	315.00							445.30	445.30	125.00
ANT. PANEL-NEW14 ANTENA RF TIPO PANEL (0.50x1.00)		54.80	1049.58	0.00	0.60	45.00							445.30	445.30	125.00
ANT. PANEL-NEW15 ANTENA RF TIPO PANEL (0.50x1.00)		54.80	1049.58	0.00	0.60	135.00							445.30	445.30	125.00
ANT. PANEL-NEW16 ANTENA RF TIPO PANEL (0.50x1.00)		54.80	1049.58	0.00	0.60	225.00							445.30	445.30	125.00

EVALUACION ESTRUCTURAL TAC50 + EXTENSION 8 m.

		TORRE 50m + ext 8 m. – SAN GIL		
		TAC50-SANGIL+EXT 8M. -AMZ	HOJA 13 / 29	REV. 0

EIA Section Load Case Information for "LC4 WIND 45°-120°":

Section Label	Z of Top (m)	Z of Bottom (m)	Ave. Above Gnd. (m)	Elev. (m)	qzGh (Pa)	Ice Thick. (cm)	Face AF (m ²)	Face AR (m ²)	Face AR*AR (m ²)	Face AG (m ²)	Face e (m)	Face DF (m ²)	Face DR (m ²)	Face RR (m ²)	Face CF (m ²)	Face AE (m ²)	Face WF (N)	NotF AAF (m ²)	NotF CAF (m ²)	NotF AAR (m ²)	NotF AAR*CAR (m ²)	NotF CAR (m ²)	NotF WA (N)	Total Wind (N)	Total Weight (N)
1	58.00	54.00	56.00	1056.10	0.00	1.10	0.00	0.00	0.00	2.4	0.46	1.20	1.20	0.68	2.13	1.3	2983	0.00	2.00	0.00	1.20	0.00	0	2983	4786
2	54.00	50.80	52.40	1036.24	0.00	0.86	0.49	0.41	1.9	0.71	1.20	1.20	0.83	1.83	1.5	2892	0.06	2.00	0.00	1.20	0.00	127	3019	4359	
3	50.80	46.00	48.40	1012.99	0.00	1.33	1.98	1.72	4.3	0.77	1.20	1.20	0.87	1.83	3.7	6775	0.24	2.00	0.00	1.20	0.00	496	7271	8258	
4	46.00	42.00	44.00	985.78	0.00	1.06	1.65	1.21	4.8	0.56	1.20	1.20	0.73	1.94	2.7	5220	0.20	2.00	0.00	1.20	0.00	402	5622	7006	
5	42.00	38.00	40.00	959.30	0.00	1.29	1.65	1.25	4.8	0.61	1.20	1.20	0.76	1.89	3.0	5521	0.20	2.00	0.00	1.20	0.00	391	5912	8708	
6	38.00	34.00	36.00	930.85	0.00	1.38	1.65	1.27	4.8	0.63	1.20	1.20	0.77	1.87	3.2	5544	0.20	2.00	0.00	1.20	0.00	380	5924	9205	
7	34.00	30.00	32.00	900.05	0.00	1.29	1.65	1.25	4.8	0.61	1.20	1.20	0.76	1.89	3.0	5180	0.20	2.00	0.00	1.20	0.00	367	5547	9278	
8	30.00	25.00	27.50	861.91	0.00	2.25	2.06	1.47	8.1	0.53	1.20	1.20	0.72	1.99	4.5	7664	0.26	2.00	0.00	1.20	0.00	440	8103	19138	
9	25.00	20.00	22.50	813.88	0.00	2.64	2.06	1.33	12.2	0.38	1.20	1.20	0.65	2.32	4.8	9006	0.26	2.00	0.00	1.20	0.00	415	9421	22369	
10	20.00	14.00	17.00	751.24	0.00	3.41	2.47	1.52	20.1	0.29	1.20	1.20	0.61	2.62	5.9	11633	0.31	2.00	0.00	1.20	0.00	460	12093	28428	
11	14.00	8.00	11.00	663.38	0.00	3.58	2.47	1.48	26.1	0.23	1.17	1.17	0.60	2.85	5.9	11207	0.31	2.00	0.00	1.20	0.00	406	11613	30629	
12	8.00	4.50	6.25	646.64	0.00	2.33	1.44	0.85	18.0	0.21	1.16	1.16	0.59	2.94	3.7	7000	0.18	2.00	0.00	1.20	0.00	231	7231	19978	
13	4.50	0.00	2.25	646.64	0.00	2.34	1.85	1.08	26.1	0.16	1.12	1.12	0.58	3.16	3.8	7813	0.23	2.00	0.00	1.20	0.00	297	8110	19262	

Concentrated Loads for Load Case "LC6 WIND 45°-60°":

Joint Label	Force X-Dir (N)	Force Y-Dir (N)	Force Vertical (N)	Moment X-Axis (N-m)	Moment Y-Axis (N-m)	Moment Z-Axis (N-m)	Load Comment
2XY	447	447	760	0	0	0	ANTENA VHF TV 170-230MHz-Quad Dipole Panel
2S	447	447	760	0	0	0	ANTENA VHF TV 170-230MHz-Quad Dipole Panel
2X	447	447	760	0	0	0	ANTENA VHF TV 170-230MHz-Quad Dipole Panel
6Y	305	305	570	0	0	0	ANTENA MOYANO FM RADIO
6XY	305	305	570	0	0	0	ANTENA MOYANO FM RADIO
6S	305	305	570	0	0	0	ANTENA MOYANO FM RADIO
6X	305	305	570	0	0	0	ANTENA MOYANO FM RADIO
9Y	305	305	570	0	0	0	ANTENA MOYANO FM RADIO
9XY	305	305	570	0	0	0	ANTENA MOYANO FM RADIO
9S	305	305	570	0	0	0	ANTENA MOYANO FM RADIO
9X	305	305	570	0	0	0	ANTENA MOYANO FM RADIO
22Y	223	223	380	0	0	0	ANTENA PANEL FM
22XY	223	223	380	0	0	0	ANTENA PANEL FM
22S	223	223	380	0	0	0	ANTENA PANEL FM
22X	223	223	380	0	0	0	ANTENA PANEL FM
1XY	0	0	800	0	0	0	PERSONAL MANTENIMIENTO
1X	0	0	800	0	0	0	PERSONAL MANTENIMIENTO
1P	0	0	800	0	0	0	PERSONAL MANTENIMIENTO



Equipment Load Case Information for "LC6 WIND 45°-60°":

Equipment Label	Equipment Property Set	Elevation Above Ground (m)	qzGh (Pa)	Ice Thick. (cm)	Total Wind Area (m²)	Wind Incidence Angle (deg)	222-G CA	222-G CS	222-G CM	Antenna Load FAM (N)	Antenna Side Load FSM (N)	Antenna Moment MM (N-m)	Long. Load (N)	Trans. Load (N)	Vert. Load (N)
ANT. MW 3.0 (1)	ANTENA MW 3.048	37.20	234.93	0.00	7.30	360.00	1.55080	0.00000	0.00000	2658.53	0.00	0.00	1879.86	1879.86	4925.00
ANT. MW 3.0 (2)	ANTENA MW 3.048	14.00	177.70	0.00	7.30	270.00	-0.01170	-0.34380	-0.13130	-15.17	-445.79	-518.92	304.49	325.95	4925.00
ANT. MW 3.0 (3)	ANTENA MW 3.048	14.00	177.70	0.00	7.30	360.00	1.55080	0.00000	0.00000	2010.85	0.00	0.00	1421.89	1421.89	4925.00
ANT. PANEL -1	ANTENA RF TIPO PANEL (0.50x1.00)	42.00	243.22	0.00	0.60	315.00							103.19	103.19	125.00
ANT. PANEL -2	ANTENA RF TIPO PANEL (0.50x1.00)	42.00	243.22	0.00	0.60	45.00							103.19	103.19	125.00
ANT. PANEL -3	ANTENA RF TIPO PANEL (0.50x1.00)	42.00	243.22	0.00	0.60	135.00							103.19	103.19	125.00
ANT. PANEL -4	ANTENA RF TIPO PANEL (0.50x1.00)	42.00	243.22	0.00	0.60	225.00							103.19	103.19	125.00
ANT. PANEL-NEW1	ANTENA RF TIPO PANEL (0.50x1.00)	57.20	265.66	0.00	0.60	315.00							112.71	112.71	125.00
ANT. PANEL-NEW2	ANTENA RF TIPO PANEL (0.50x1.00)	57.20	265.66	0.00	0.60	45.00							112.71	112.71	125.00
ANT. PANEL-NEW3	ANTENA RF TIPO PANEL (0.50x1.00)	57.20	265.66	0.00	0.60	135.00							112.71	112.71	125.00
ANT. PANEL-NEW4	ANTENA RF TIPO PANEL (0.50x1.00)	57.20	265.66	0.00	0.60	225.00							112.71	112.71	125.00
ANT. PANEL-NEW5	ANTENA RF TIPO PANEL (0.50x1.00)	56.40	264.59	0.00	0.60	315.00							112.26	112.26	125.00
ANT. PANEL-NEW6	ANTENA RF TIPO PANEL (0.50x1.00)	56.40	264.59	0.00	0.60	45.00							112.26	112.26	125.00
ANT. PANEL-NEW7	ANTENA RF TIPO PANEL (0.50x1.00)	56.40	264.59	0.00	0.60	135.00							112.26	112.26	125.00
ANT. PANEL-NEW8	ANTENA RF TIPO PANEL (0.50x1.00)	56.40	264.59	0.00	0.60	225.00							112.26	112.26	125.00
ANT. PANEL-NEW9	ANTENA RF TIPO PANEL (0.50x1.00)	55.60	263.52	0.00	0.60	315.00							111.80	111.80	125.00
ANT. PANEL-NEW10	ANTENA RF TIPO PANEL (0.50x1.00)	55.60	263.52	0.00	0.60	45.00							111.80	111.80	125.00
ANT. PANEL-NEW11	ANTENA RF TIPO PANEL (0.50x1.00)	55.60	263.52	0.00	0.60	135.00							111.80	111.80	125.00
ANT. PANEL-NEW12	ANTENA RF TIPO PANEL (0.50x1.00)	55.60	263.52	0.00	0.60	225.00							111.80	111.80	125.00
ANT. PANEL-NEW13	ANTENA RF TIPO PANEL (0.50x1.00)	54.80	262.43	0.00	0.60	315.00							111.34	111.34	125.00
ANT. PANEL-NEW14	ANTENA RF TIPO PANEL (0.50x1.00)	54.80	262.43	0.00	0.60	45.00							111.34	111.34	125.00
ANT. PANEL-NEW15	ANTENA RF TIPO PANEL (0.50x1.00)	54.80	262.43	0.00	0.60	135.00							111.34	111.34	125.00
ANT. PANEL-NEW16	ANTENA RF TIPO PANEL (0.50x1.00)	54.80	262.43	0.00	0.60	225.00							111.34	111.34	125.00

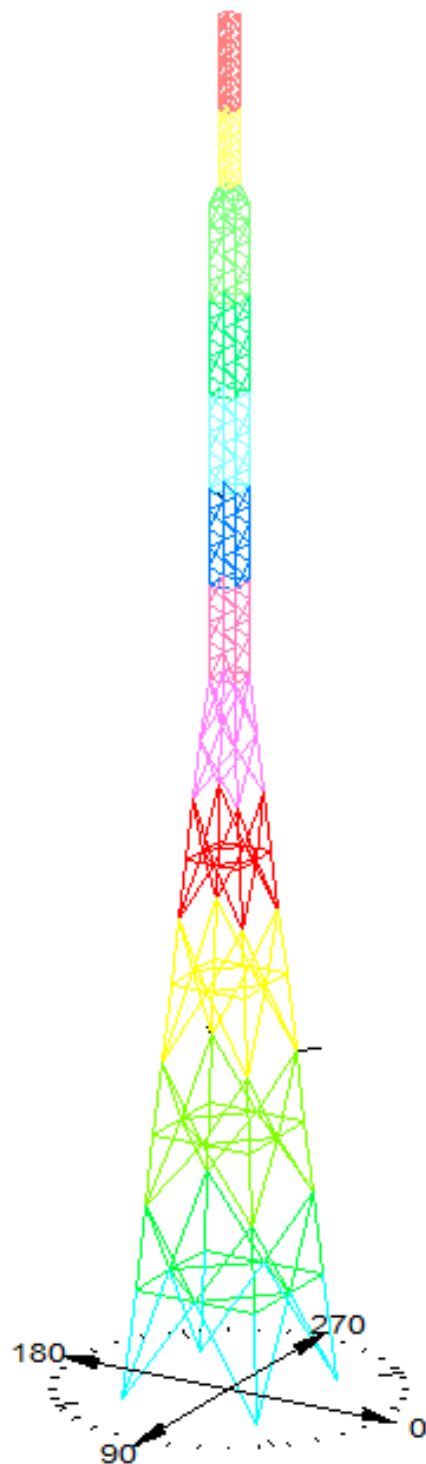
EIA Section Load Case Information for "LC6 WIND 45°-60°":

Section Label	Z of Top (m)	Z of Bottom (m)	Ave. Above Gnd. (m)	Elev. (m)	qzGh (Pa)	Ice Thick. (cm)	Face AF (m ²)	Face AR (m ²)	Face RR*AR (m ²)	Face AG (m ²)	Face e	Face DF	Face DR	Face RR	Face CF	Face AE (m ²)	Face WF (N)	NotF AAF (m ²)	NotF CAF	NotF AAR (m ²)	NotF AAR*CAR	NotF CAR	NotF WA (N)	Total Wind (N)	Total Weight (N)
1	58.00	54.00	56.00	264.06	0.00	1.10	0.00	0.00	0.00	2.4	0.46	1.20	1.20	0.68	2.13	1.3	746	0.00	2.00	0.00	1.20	0.00	0	746	4786
2	54.00	50.80	52.40	259.09	0.00	0.86	0.49	0.41	1.9	0.71	1.20	1.20	0.83	1.83	1.5	723	0.06	2.00	0.00	1.20	0.00	32	755	4359	
3	50.80	46.00	48.40	253.28	0.00	1.33	1.98	1.72	4.3	0.77	1.20	1.20	0.87	1.83	3.7	1694	0.24	2.00	0.00	1.20	0.00	124	1818	8258	
4	46.00	42.00	44.00	246.47	0.00	1.06	1.65	1.21	4.8	0.56	1.20	1.20	0.73	1.94	2.7	1305	0.20	2.00	0.00	1.20	0.00	101	1406	7006	
5	42.00	38.00	40.00	239.85	0.00	1.29	1.65	1.25	4.8	0.61	1.20	1.20	0.76	1.89	3.0	1380	0.20	2.00	0.00	1.20	0.00	98	1478	8708	
6	38.00	34.00	36.00	232.74	0.00	1.38	1.65	1.27	4.8	0.63	1.20	1.20	0.77	1.87	3.2	1386	0.20	2.00	0.00	1.20	0.00	95	1481	9205	
7	34.00	30.00	32.00	225.04	0.00	1.29	1.65	1.25	4.8	0.61	1.20	1.20	0.76	1.89	3.0	1295	0.20	2.00	0.00	1.20	0.00	92	1387	9278	
8	30.00	25.00	27.50	215.50	0.00	2.25	2.06	1.47	8.1	0.53	1.20	1.20	0.72	1.99	4.5	1916	0.26	2.00	0.00	1.20	0.00	110	2026	19138	
9	25.00	20.00	22.50	203.49	0.00	2.64	2.06	1.33	12.2	0.38	1.20	1.20	0.65	2.32	4.8	2252	0.26	2.00	0.00	1.20	0.00	104	2356	22369	
10	20.00	14.00	17.00	187.83	0.00	3.41	2.47	1.52	20.1	0.29	1.20	1.20	0.61	2.62	5.9	2909	0.31	2.00	0.00	1.20	0.00	115	3024	28428	
11	14.00	8.00	11.00	165.87	0.00	3.58	2.47	1.48	26.1	0.23	1.17	1.17	0.60	2.85	5.9	2802	0.31	2.00	0.00	1.20	0.00	102	2904	30629	
12	8.00	4.50	6.25	161.68	0.00	2.33	1.44	0.85	18.0	0.21	1.16	1.16	0.59	2.94	3.7	1750	0.18	2.00	0.00	1.20	0.00	58	1808	19978	
13	4.50	0.00	2.25	161.68	0.00	2.34	1.85	1.08	26.1	0.16	1.12	1.12	0.58	3.16	3.8	1953	0.23	2.00	0.00	1.20	0.00	74	2028	19262	

EVALUACION ESTRUCTURAL TAC50 + EXTENSION 8 m.

		TORRE 50m + ext 8 m. – SAN GIL		
		TAC50-SANGIL+EXT 8M. -AMZ	HOJA 14 / 29	REV. 0

SILUETA TAC50 + EXTENSION 8 m -SECCIONES



EVALUACION ESTRUCTURAL TAC50 + EXTENSION 8 m.



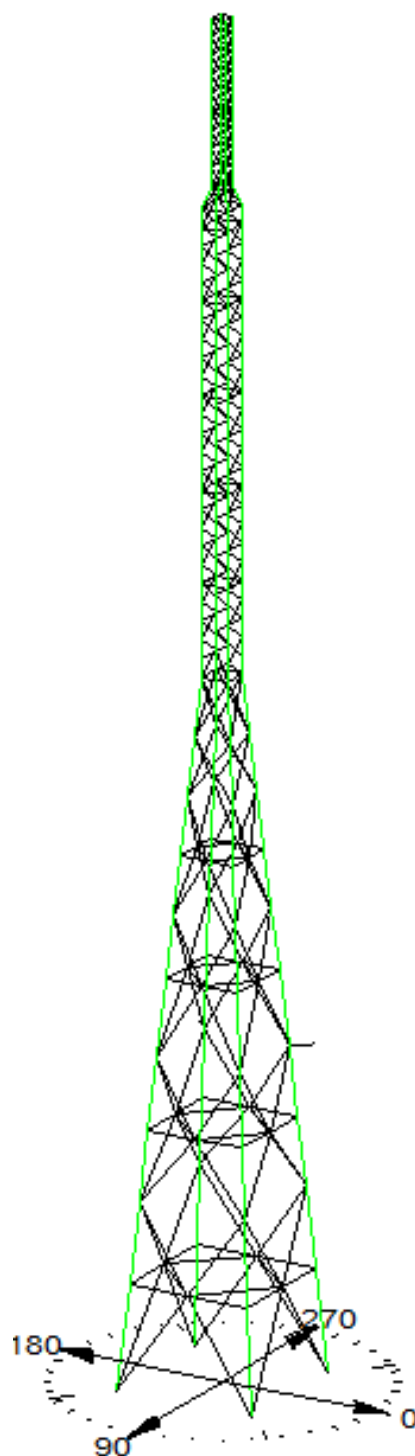
TORRE 50m + ext 8 m. – SAN GIL

TAC50-SANGIL+EXT 8M. -AMZ

HOJA
15 / 29

REV.
0

SILUETA - TAC50 + EXTENSION 8 m - GRUPOS



EVALUACION ESTRUCTURAL TAC50 + EXTENSION 8 m.



TORRE 50m + ext 8 m. – SAN GIL

TAC50-SANGIL+EXT 8M. -AMZ

HOJA
16 / 29

REV.
0

RESUMEN

Project Name: TORRE 50 m - SAN GIL + EXTENSION - SANTANDER -ACT.
 Project Notes: BTESA - RTVC
 Project File : c:\users\leopoldo.barrera\documents\01- ingenieria & diseNo\pls\work\j. bustos\05- evalaucion torre san gil + extensión\50m-120kmh+ext.tow
 Date run : 11:20:02 a.m. miércoles, 22 de junio de 2016
 by : Tower Version 14.20
 Licensed to : Ing Leopoldo Barrera - Colombia

Successfully performed linear analysis

Member check option: TIA/EIA 222-F
 Connection rupture check: Not Checked
 Crossing diagonal check: ASCE 10 [Alternate Unsupported RLOUT = 1]
 Included angle check: None
 Climbing load check: None
 Redundant members checked with: Actual Force
 Loads from file: c:\users\leopoldo.barrera\documents\01- ingenieria & diseNo\pls\work\j. bustos\05- evalaucion torre san gil + extensión\50m-120kmh-act.eia

*** Analysis Results:

Maximum element usage is 205.52% for Angle "25P" in load case "LC4 WIND 45°-120" NG

Summary of Joint Support Reactions For All Load Cases:

Load Case	Joint Label	Long. Force (kN)	Tran. Force (kN)	Vert. Force (kN)	Shear Force (kN)	Tran. Moment (kN-m)	Long. Moment (kN-m)	Bending Moment (kN-m)	Vert. Moment (kN-m)	Found. Usage %
LC3 WIND 0°-120	ANP	-42.49	-38.71	-445.16	57.48	-0.97	0.51	1.09	0.13	0.00
LC3 WIND 0°-120	ANX	-28.54	26.76	-285.62	39.12	0.64	0.12	0.65	-0.20	0.00
LC3 WIND 0°-120	ANXY	-35.52	-30.89	335.44	47.07	-0.57	0.36	0.67	1.55	0.00
LC3 WIND 0°-120	ANY	-21.09	19.42	175.90	28.67	0.29	-0.09	0.31	-0.60	0.00
LC4 WIND 45°-120	ANP	-55.95	-55.67	-595.21	78.92	-0.94	0.90	1.30	0.16	0.00
LC4 WIND 45°-120	ANX	-6.48	2.18	-53.82	6.93	0.53	-0.31	0.62	-0.53	0.00
LC4 WIND 45°-120	ANXY	-47.18	-46.72	486.39	66.40	-0.72	0.68	0.99	-0.16	0.00
LC4 WIND 45°-120	ANY	2.04	-7.44	-56.80	7.72	0.50	-0.71	0.87	2.47	0.00
LC6 WIND 45°-60	ANP	-17.84	-17.76	-188.42	25.17	-0.29	0.28	0.40	0.04	0.00
LC6 WIND 45°-60	ANX	-5.52	4.39	-53.56	7.05	0.19	-0.03	0.19	-0.13	0.00
LC6 WIND 45°-60	ANXY	-7.90	-7.77	78.92	11.08	-0.11	0.10	0.15	-0.04	0.00
LC6 WIND 45°-60	ANY	4.37	-5.77	-56.38	7.23	0.06	-0.25	0.25	0.62	0.00

Summary of Joint Support Reactions For All Load Cases in Direction of Leg:

Load Case	Support Joint	Origin Joint	Leg Member	Force In Leg Dir. (kN)	Residual Shear Perpendicular To Leg (kN)	Residual Shear Horizontal To Leg - Res. (kN)	Residual Shear Horizontal To Leg - Long. (kN)	Total Long. Force (kN)	Total Tran. Force (kN)	Total Vert. Force (kN)
LC3 WIND 0°-120	ANP	75S	35P	448.818	5.783	5.814	5.542	1.757	-42.49	-38.71
LC3 WIND 0°-120	ANX	75X	35X	288.233	5.677	5.714	4.829	-3.054	-28.54	26.76
LC3 WIND 0°-120	ANXY	75XY	35XY	-338.628	8.211	8.259	7.674	3.052	-35.52	-30.89
LC3 WIND 0°-120	ANY	75Y	35Y	-178.041	8.031	8.085	6.490	-4.822	-21.09	19.42
LC4 WIND 45°-120	ANP	75S	35P	600.354	8.997	9.058	6.543	6.264	-55.95	-55.67
LC4 WIND 45°-120	ANX	75X	35X	54.170	3.049	3.049	2.012	2.291	-6.48	2.18
LC4 WIND 45°-120	ANXY	75XY	35XY	-490.815	9.245	9.308	6.808	6.348	-47.18	-46.72
LC4 WIND 45°-120	ANY	75Y	35Y	57.190	3.823	3.823	2.677	2.728	2.04	-7.44
LC6 WIND 45°-60	ANP	75S	35P	190.068	3.037	3.058	2.203	2.121	-17.84	-17.76
LC6 WIND 45°-60	ANX	75X	35X	54.009	1.068	1.072	1.070	0.058	-5.52	4.39
LC6 WIND 45°-60	ANXY	75XY	35XY	-79.673	1.806	1.818	1.348	1.221	-7.90	-7.77
LC6 WIND 45°-60	ANY	75Y	35Y	56.834	1.131	1.133	0.314	1.088	4.37	-5.77

Overturning Moment Summary For All Load Cases:

Load Case	Transverse Moment (kN-m)	Longitudinal Moment (kN-m)	Resultant Moment (kN-m)
LC3 WIND 0°-120	985.952	3838.166	3962.779
LC4 WIND 45°-120	3351.339	3332.968	4726.537
LC6 WIND 45°-60	834.800	817.341	1168.305

EIA Sections Information:

Section Label	Top Z (m)	Bottom Z (m)	Joint Count	Member Count	Top Width (m)	Bottom Width (m)	Gross Area (m^2)	Face Adj Factor	Face Ar Adj Factor	Dead Load Factor
1	58.000	54.000	24	68	0.60	0.60	2.40	1.0250	1.0000	1.500
2	54.000	50.800	20	52	0.60	0.60	1.92	1.0250	1.0000	1.500
3	50.800	46.000	28	64	0.60	1.20	4.32	1.0250	1.0000	1.500
4	46.000	42.000	24	44	1.20	1.20	4.80	1.0250	1.0000	1.500
5	42.000	38.000	24	44	1.20	1.20	4.80	1.0250	1.0000	1.500
6	38.000	34.000	24	44	1.20	1.20	4.80	1.0250	1.0000	1.500
7	34.000	30.000	24	44	1.20	1.20	4.80	1.0250	1.0000	1.500
8	30.000	25.000	12	24	1.20	2.03	8.07	1.0500	1.0000	1.500
9	25.000	20.000	16	36	2.03	2.86	12.22	1.1000	1.0000	1.500
10	20.000	14.000	16	36	2.86	3.86	20.15	1.1000	1.0000	1.500
11	14.000	8.000	16	36	3.86	4.85	26.12	1.1000	1.0000	1.500
12	8.000	4.500	12	24	4.85	5.43	18.00	1.1250	1.0000	1.500
13	4.500	0.000	12	12	5.43	6.18	26.13	1.1250	1.0000	1.500

EVALUACION ESTRUCTURAL TAC50 + EXTENSION 8 m.



TORRE 50m + ext 8 m. - SAN GIL

TAC50-SANGIL+EXT 8M. -AMZ

HOJA
17 / 29

REV.
0

*** Overall summary for all load cases - Usage = Maximum Stress / Allowable Stress
Printed capacities do not include IIA allowable stress increase for wind load cases.
Printed capacities do not include the strength factor entered for each load case.
The Group Summary reports on the member and load case that resulted in maximum usage
which may not necessarily be the same as that which produces maximum force.

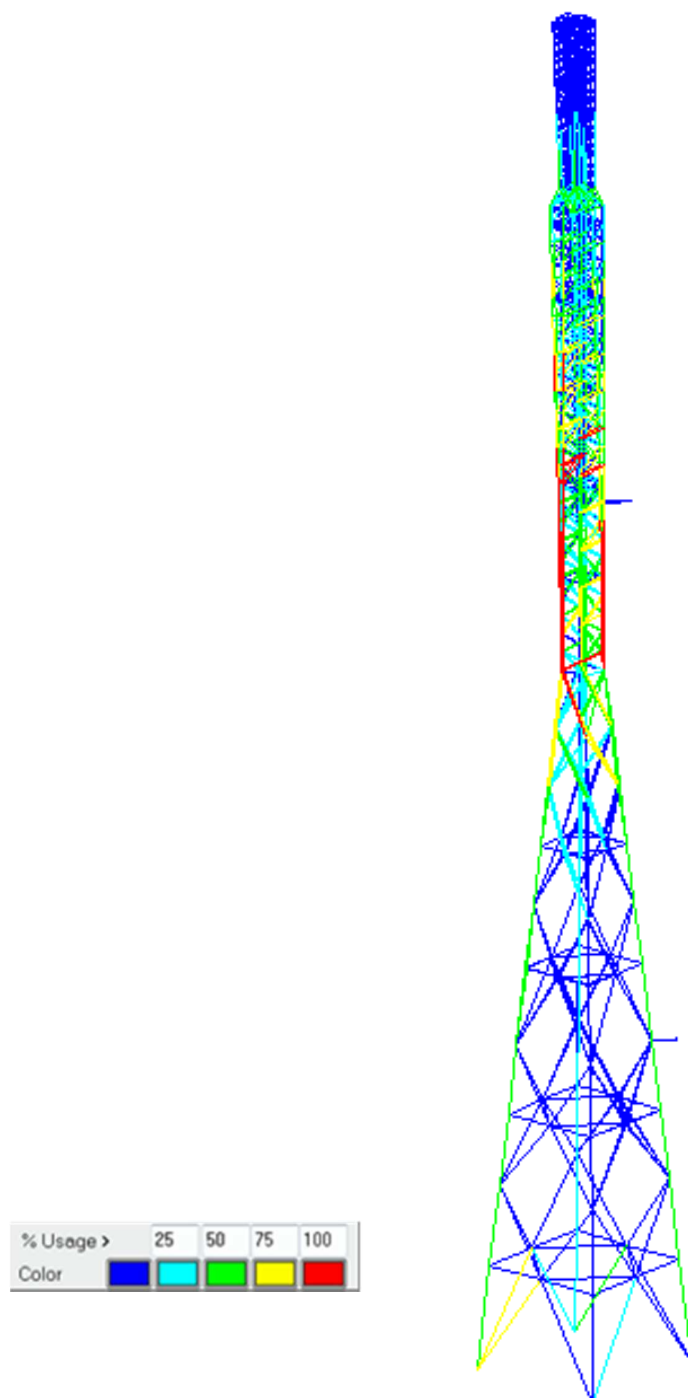
Group Summary (Compression Portion):

Group Label	Group Desc.	Angle Type	Angle Size	Steel Strength	Max Usage	Usage Control	Max Comp. In Member	Comp. Force	Comp. Control Load Case	L/r Capacity	Comp. Shear Capacity	Comp. Bearing Capacity	RLX	RLY	RLZ	L/r	KL/r	Length Member	Curve No.	No. Of Bolts	Comp.
				(MPa)	%		%	(kN)		(kN)	(kN)	(kN)						(m)			
M0	M0	SAE	2.5X2.5X0.25	344.7	21.66	Comp	21.66	220P	-25.221LC4	WIND	116.439	903.167	433.700	1.000	1.000	1.000	64.15	64.15	0.800	1	8
M1A	M1A	SAE	2.5X2.5X0.25	344.7	65.68	Comp	65.68	224P	-76.472LC4	WIND	116.439	0.000	0.000	1.000	1.000	1.000	64.15	64.15	0.800	1	0
M1	M1	SAE	2.5X2.5X0.25	344.7	99.49	Comp	99.49	5P	-115.844LC4	WIND	116.439	903.167	433.700	1.000	1.000	1.000	64.15	64.15	0.800	1	8
M2	M2	SAE	3X3X0.3125	344.7	117.51	Comp	117.51	10P	-221.434LC4	WIND	188.445	903.167	542.126	1.000	1.000	1.000	53.47	53.47	0.800	1	8 NG
M3	M3	SAE	4X4X0.375	344.7	108.08	Comp	108.08	15P	-355.236LC4	WIND	328.688	903.167	650.551	1.000	1.000	1.000	39.97	39.97	0.800	1	8 NG
M4	M4	SAE	4X4X0.375	344.7	154.12	Comp	154.12	20P	-506.582LC4	WIND	328.688	903.167	650.551	1.000	1.000	1.000	39.97	39.97	0.800	1	8 NG
M5	M5	SAE	4X4X0.375	344.7	205.52	Comp	205.52	25P	-675.534LC4	WIND	328.688	903.167	650.551	1.000	1.000	1.000	39.97	39.97	0.800	1	8 NG
M6	M6	SAE	6X6X0.625	344.7	80.49	Comp	80.49	26P	-650.373LC4	WIND	808.048	903.167	1084.251	0.500	0.500	0.500	41.99	41.99	2.517	1	8
M7	M7	SAE	6X6X0.625	344.7	69.58	Comp	69.58	29P	-562.261LC4	WIND	808.048	903.167	1084.251	0.500	0.500	0.500	41.99	41.99	2.517	1	8
M8	M8	SAE	6X6X0.625	344.7	73.28	Comp	73.28	31P	-544.261LC4	WIND	742.672	903.167	1084.251	0.500	0.500	0.500	55.43	55.43	3.323	1	8
M9	M9	SAE	6X6X0.625	344.7	72.63	Comp	72.63	33P	-557.913LC4	WIND	768.205	903.167	1084.251	0.500	0.500	0.500	50.39	50.39	3.021	1	8
M10	M10	SAE	6X6X0.625	344.7	69.72	Comp	69.72	34P	-572.231LC4	WIND	820.725	903.167	1084.251	0.333	0.333	0.333	39.15	39.15	3.524	1	8
M11	M11	SAE	6X6X0.625	344.7	74.85	Comp	74.85	35P	-575.193LC4	WIND	768.454	903.167	1084.251	0.333	0.333	0.333	50.34	50.34	4.531	1	8
D1	D1	SAE	2X2X0.1875	344.7	35.74	Comp	35.74	37AR	-9.272LC3	WIND	25.943	112.896	81.319	1.000	1.000	1.000	144.11	134.83	1.442	6	2
D2	D2	SAE	2X2X0.1875	344.7	54.19	Comp	54.19	39P	-14.058LC3	WIND	25.943	112.896	81.319	1.000	1.000	1.000	144.11	134.83	1.442	6	2
D3	D3	SAE	2X2X0.1875	344.7	59.53	Comp	59.53	41AR	-15.444LC3	WIND	25.943	112.896	81.319	1.000	1.000	1.000	144.11	134.83	1.442	6	2
D4	D4	SAE	2X2X0.1875	344.7	58.04	Comp	58.04	43P	-15.058LC3	WIND	25.943	112.896	81.319	1.000	1.000	1.000	144.11	134.83	1.442	6	2
D5	D5	SAE	2X2X0.1875	344.7	63.53	Comp	63.53	45AR	-16.482LC3	WIND	25.943	112.896	81.319	1.000	1.000	1.000	144.11	134.83	1.442	6	2
D6	D6	SAE	2X2X0.1875	344.7	71.53	Comp	71.53	47P	-18.557LC3	WIND	25.943	112.896	81.319	1.000	1.000	1.000	144.11	134.83	1.442	6	2
D7	D7	SAE	2X2X0.1875	344.7	76.93	Comp	76.93	49AR	-19.959LC3	WIND	25.943	112.896	81.319	1.000	1.000	1.000	144.11	134.83	1.442	6	2
D8	D8	SAE	2X2X0.1875	344.7	77.30	Comp	77.30	51P	-20.055LC3	WIND	25.943	112.896	81.319	1.000	1.000	1.000	144.11	134.83	1.442	6	2
D9	D9	SAE	2X2X0.1875	344.7	86.74	Comp	86.74	53AR	-22.504LC3	WIND	25.943	112.896	81.319	1.000	1.000	1.000	144.11	134.83	1.442	6	2
D10	D10	SAE	2X2X0.1875	344.7	88.37	Comp	88.37	55P	-22.926LC3	WIND	25.943	112.896	81.319	1.000	1.000	1.000	144.11	134.83	1.442	6	2
D11	D11	SAE	2X2X0.1875	344.7	98.42	Comp	98.42	57AR	-25.534LC3	WIND	25.943	112.896	81.319	1.000	1.000	1.000	144.11	134.83	1.442	6	2
D12	D12	SAE	2.5X2.5X0.1875	344.7	97.92	Comp	97.92	59P	-25.403LC3	WIND	25.943	112.896	81.319	1.000	1.000	1.000	144.11	134.83	1.442	1	2
D13	D13	SAE	2X2X0.1875	344.7	104.17	Comp	104.17	61AR	-27.025LC3	WIND	25.943	112.896	81.319	1.000	1.000	1.000	144.11	134.83	1.442	6	2 NG
D14	D14	SAE	2X2X0.1875	344.7	102.06	Comp	102.06	63P	-26.478LC3	WIND	25.943	112.896	81.319	1.000	1.000	1.000	144.11	134.83	1.442	6	2 NG
D15	D15	SAE	2X2X0.1875	344.7	105.48	Comp	105.48	65AR	-27.365LC3	WIND	25.943	112.896	81.319	1.000	1.000	1.000	144.11	134.83	1.442	6	2 NG
D16	D16	SAE	2.5X2.5X0.1875	344.7	62.53	Comp	62.53	67P	-28.476LC3	WIND	45.536	112.896	81.319	1.000	1.000	1.000	114.71	114.71	1.442	1	2
D17	D17	SAE	2.5X2.5X0.1875	344.7	85.78	Comp	85.78	69AR	-39.059LC3	WIND	45.536	112.896	81.319	1.000	1.000	1.000	114.71	114.71	1.442	1	2
D18	D18	SAE	2.5X2.5X0.1875	344.7	75.96	Comp	75.96	70P	-34.589LC4	WIND	45.536	112.896	81.319	1.000	1.000	1.000	114.71	114.71	1.442	1	2
D19	D19	SAE	2.5X2.5X0.1875	344.7	87.86	Comp	87.86	73AR	-40.010LC3	WIND	45.536	112.896	81.319	1.000	1.000	1.000	114.71	114.71	1.442	1	2
D20	D20	SAE	2.5X2.5X0.1875	344.7	72.15	Comp	72.15	74P	-32.853LC4	WIND	45.536	112.896	81.319	1.000	1.000	1.000	114.71	114.71	1.442	1	2
D21	D21	SAE	2.5X2.5X0.1875	344.7	90.81	Comp	90.81	77AR	-41.351LC3	WIND	45.536	112.896	81.319	1.000	1.000	1.000	114.71	114.71	1.442	1	2
D22	D22	SAE	2.5X2.5X0.1875	344.7	89.75	Comp	89.75	78P	-40.868LC4	WIND	45.536	112.896	81.319	1.000	1.000	1.000	114.71	114.71	1.442	1	2
D23	D23	SAE	2.5X2.5X0.1875	344.7	98.50	Comp	98.50	81AR	-44.853LC3	WIND	45.536	112.896	81.319	1.000	1.000	1.000	114.71	114.71	1.442	1	2
D24	D24	SAE	2.5X2.5X0.1875	344.7	73.50	Comp	73.50	83P	-33.468LC3	WIND	45.536	112.896	81.319	1.000	1.000	1.000	114.71	114.71	1.442	1	2
D25	D25	SAE	2.5X2.5X0.1875	344.7	124.60	Comp	124.60	84AR	-39.219LC4	WIND	31.475	112.896	81.319	1.000	1.000	1.000	149.22	137.97	1.876	6	2 NG
D26	D26	SAE	2X2X0.1875	344.7	120.43	Comp	120.43	87P	-31.358LC4	WIND	26.038	112.896	81.319	0.750	0.500	0.500	143.71	134.58	2.876	6	2 NG
D27	D27	SAE	2X2X0.1875	344.7	98.26	Comp	98.26	88Y	-23.154LC4	WIND	23.563	112.896	81.319	0.750	0.500	0.500	154.92	141.48	3.101	6	2
D28	D28	SAE	2.5X2.5X0.25	344.7	40.51	Comp	40.51	97P	-18.543LC4	WIND	45.778	112.896	108.425	1.000	0.500	0.500	138.55	131.41	2.706	6	2
D29	D29	SAE	2.5X2.5X0.25	344.7	31.14	Comp	31.14	104P	-13.094LC4	WIND	42.044	112.896	108.425	1.000	0.500	0.500	147.83	137.12	2.888	6	2
D30	D30	SAE	3X3X0.25	344.7	20.10	Comp	20.10	106P	-12.121LC4	WIND	60.290	112.896	108.425	1.000	0.500	0.500	129.69	125.96	3.064	6	2
D31	D31	SAE	3X3X0.25	344.7	16.61	Comp	16.61	120P	-7.457LC3	WIND	44.899	112.896	108.425	1.000	0.500	0.500	162.21	145.96	3.832	6	2
D32	D32	SAE	3X3X0.25	344.7	18.91	Comp	18.91	124P	-9.327LC3	WIND	49.316	112.896	108.425	1.000	0.500	0.500	151.33	139.27	3.575	6	2
D33	D33	SAE	3X3X0.3125	344.7	22.58	Comp	22.58	135P	-12.236LC3	WIND	54.177	112.896	135.531	1.000	0.500	0.500	165.09	147.73	3.866	6	2
D34	D34	SAE	3X3X0.3125	344.7	16.05	Comp	16.05	139P	-7.575LC4	WIND	47.187	112.896	135.531	1.000	0.330	0.330	182.27	158.29	4.268	6	2
D35	D35	SAE	2.5X2.5X0.25	344.7	83.28	Comp	83.28	146P	-13.791LC4	WIND	16.561	112.896	108.425	1.000	0.330	0.330	280.12	218.48	5.472	6	2
D36	D36	SAE	2X2X0.1875	344.7	1.20	Tens	0.41	226G	-0.168LC4	WIND	46.501	56.448	40.659	1.000	1.000	1.000	99.92	99.92	1.000	1	1
D37	D37	SAE	2X2X0.1875	344.7	3.76	Comp	3.76	229Y	-1.531LC3	WIND	46.501	56.448	40.659	1.000	1.000	1.000	99.92	99.92	1.000	1	1
D38	D38	SAE	2X2X0.1875	344.7	6.71	Tens	6.19	231XY	-2.517LC3	WIND	46.501	56.448	40.659	1.000	1.000	1.000	99.92	99.92	1.000	1	1
D39	D39	SAE	2X2X0.1875	344.7	9.72	Tens	9.72	233Y	-3.950LC3	WIND	46.501	56.448	40.659	1.000	1.000	1.000	99.92	99.92	1.000	1	1
D40	D40	SAE	2X2X0.1875	344.7	12.73	Tens	12.15	235XY	-4.939LC3	WIND	46.501	56.448	40.659	1.000	1.000	1.000	99.92	99.92	1.000	1	1
D41	D41	SAE	2X2X0.1875	344.7	13.89	Tens	13.17	237Y	-5.354LC3	WIND	46.501	56.448	40.659	1.000	1.000	1.000	99.92	99.92	1.000	1	1
D42	D42	SAE	2X2X0.1875	344.7	14.25	Comp	14.25	239XY	-5.793LC3	WIND	46.501	56.448	40.659	1.000	1.000	1.000	99.92	99.92	1.000	1	1
D43	D43	SAE	2X2X0.1875	344.7	15.00	Tens	14.56	241Y	-5.919LC3	WIND	46.501	56.448	40.659	1.000	1.000	1.000	99.92	99.92	1.000	1	1
D44	D44	SAE																			

Group Summary (Tension Portion):

Group Label	Group Desc.	Angle Type	Angle Size	Steel Strength	Max Usage	Max Usage Control	Max Tension Use Control	Tension Force	Tension Control	Net Section Capacity	Tension Connect. Shear Capacity	Tension Connect. Bearing Capacity	Tension Connect. Rupture Capacity	Length Tens. (m)	No. Of Bolts	No. Of Holes	Hole Diameter (cm)	
				(MPa)	%		Tens. %	(kN)	Case	(kN)	(kN)	(kN)	(kN)	(m)	Tens.		(cm)	
M0	M0	SAE	2.5X2.5X0.25	344.7	21.66	Comp	17.85	220XY	21.844LC4	WIND	122.340	903.167	433.700	0.000	0.800	8	2.000	1.746
M1A	M1A	SAE	2.5X2.5X0.25	344.7	65.68	Comp	50.12	225XY	61.320LC4	WIND	122.340	903.167	433.700	0.000	0.906	8	2.000	1.746
M1	M1	SAE	2.5X2.5X0.25	344.7	99.49	Comp	78.51	15XY	96.049LC4	WIND	122.340	903.167	433.700	0.000	0.800	8	2.000	1.746
M2	M2	SAE	3X3X0.3125	344.7	117.51	Comp	94.76	10XY	184.973LC4	WIND	195.209	903.167	542.126	0.000	0.800	8	2.000	1.746 NG
M3	M3	SAE	4X4X0.375	344.7	108.08	Comp	90.80	15XY	307.734LC4	WIND	338.919	903.167	650.551	0.000	0.800	8	2.000	1.746 NG
M4	M4	SAE	4X4X0.375	344.7	154.12	Comp	139.84	20XY	473.961LC4	WIND	338.919	903.167	650.551	0.000	0.800	8	2.000	1.746 NG
M5	M5	SAE	4X4X0.375	344.7	205.52	Comp	200.66	25XY	680.073LC4	WIND	338.919	903.167	650.551	0.000	0.800	8	2.000	1.746 NG
M6	M6	SAE	6X6X0.625	344.7	80.49	Comp	70.71	26XY	638.599LC4	WIND	903.633	903.167	1084.251	0.000	2.517	8	2.000	1.746
M7	M7	SAE	6X6X0.625	344.7	69.58	Comp	56.64	28XY	511.538LC4	WIND	903.633	903.167	1084.251	0.000	2.517	8	2.000	1.746
M8	M8	SAE	6X6X0.625	344.7	73.28	Comp	53.85	30XY	486.367LC4	WIND	903.633	903.167	1084.251	0.000	2.719	8	2.000	1.746
M9	M9	SAE	6X6X0.625	344.7	72.63	Comp	53.39	32XY	482.233LC4	WIND	903.633	903.167	1084.251	0.000	3.021	8	2.000	1.746
M10	M10	SAE	6X6X0.625	344.7	69.72	Comp	52.39	34XY	473.148LC4	WIND	903.633	903.167	1084.251	0.000	3.524	8	2.000	1.746
M11	M11	SAE	6X6X0.625	344.7	74.85	Comp	51.99	35XY	469.582LC4	WIND	903.633	903.167	1084.251	0.000	4.531	8	2.000	1.746
D1	D1	SAE	2X2X0.1875	344.7	35.74	Comp	15.92	37P	10.032LC3	WIND	63.005	112.896	81.319	0.000	1.442	2	1.000	1.746
D2	D2	SAE	2X2X0.1875	344.7	54.19	Comp	23.90	39AR	15.060LC3	WIND	63.005	112.896	81.319	0.000	1.442	2	1.000	1.746
D3	D3	SAE	2X2X0.1875	344.7	59.53	Comp	23.04	41P	14.518LC3	WIND	63.005	112.896	81.319	0.000	1.442	2	1.000	1.746
D4	D4	SAE	2X2X0.1875	344.7	58.04	Comp	25.39	43AR	15.998LC3	WIND	63.005	112.896	81.319	0.000	1.442	2	1.000	1.746
D5	D5	SAE	2X2X0.1875	344.7	63.53	Comp	24.62	45P	15.514LC3	WIND	63.005	112.896	81.319	0.000	1.442	2	1.000	1.746
D6	D6	SAE	2X2X0.1875	344.7	71.53	Comp	30.94	47AR	19.497LC3	WIND	63.005	112.896	81.319	0.000	1.442	2	1.000	1.746
D7	D7	SAE	2X2X0.1875	344.7	76.93	Comp	30.17	49P	19.010LC3	WIND	63.005	112.896	81.319	0.000	1.442	2	1.000	1.746
D8	D8	SAE	2X2X0.1875	344.7	77.30	Comp	33.34	51AR	21.008LC3	WIND	63.005	112.896	81.319	0.000	1.442	2	1.000	1.746
D9	D9	SAE	2X2X0.1875	344.7	86.74	Comp	34.20	53P	21.549LC3	WIND	63.005	112.896	81.319	0.000	1.442	2	1.000	1.746
D10	D10	SAE	2X2X0.1875	344.7	88.37	Comp	37.87	55AR	23.861LC3	WIND	63.005	112.896	81.319	0.000	1.442	2	1.000	1.746
D11	D11	SAE	2X2X0.1875	344.7	98.42	Comp	38.94	57P	24.534LC3	WIND	63.005	112.896	81.319	0.000	1.442	2	1.000	1.746
D12	D12	SAE	2X2X0.1875	344.7	97.92	Comp	53.76	59AR	26.357LC3	WIND	49.029	112.896	81.319	0.000	1.442	2	1.000	1.746
D13	D13	SAE	2X2X0.1875	344.7	104.17	Comp	53.21	61P	26.088LC3	WIND	49.029	112.896	81.319	0.000	1.442	2	1.000	1.746 NG
D14	D14	SAE	2X2X0.1875	344.7	102.06	Comp	55.99	63AR	27.450LC3	WIND	49.029	112.896	81.319	0.000	1.442	2	1.000	1.746 NG
D15	D15	SAE	2X2X0.1875	344.7	105.48	Comp	53.84	65P	26.396LC3	WIND	49.029	112.896	81.319	0.000	1.442	2	1.000	1.746 NG
D16	D16	SAE	2.5X2.5X0.1875	344.7	62.53	Comp	36.35	67AR	29.560LC3	WIND	83.823	112.896	81.319	0.000	1.442	2	1.000	1.746
D17	D17	SAE	2.5X2.5X0.1875	344.7	85.78	Comp	34.98	69P	28.446LC3	WIND	83.823	112.896	81.319	0.000	1.442	2	1.000	1.746
D18	D18	SAE	2.5X2.5X0.1875	344.7	75.96	Comp	48.41	71AR	39.363LC3	WIND	83.823	112.896	81.319	0.000	1.442	2	1.000	1.746
D19	D19	SAE	2.5X2.5X0.1875	344.7	87.86	Comp	43.17	72P	35.105LC4	WIND	83.823	112.896	81.319	0.000	1.442	2	1.000	1.746
D20	D20	SAE	2.5X2.5X0.1875	344.7	72.15	Comp	50.49	75AR	41.059LC3	WIND	83.823	112.896	81.319	0.000	1.442	2	1.000	1.746
D21	D21	SAE	2.5X2.5X0.1875	344.7	90.81	Comp	40.04	76P	32.560LC4	WIND	83.823	112.896	81.319	0.000	1.442	2	1.000	1.746
D22	D22	SAE	2.5X2.5X0.1875	344.7	89.75	Comp	53.20	79AR	43.261LC3	WIND	83.823	112.896	81.319	0.000	1.442	2	1.000	1.746
D23	D23	SAE	2.5X2.5X0.1875	344.7	98.50	Comp	59.36	80P	48.269LC4	WIND	83.823	112.896	81.319	0.000	1.442	2	1.000	1.746
D24	D24	SAE	2.5X2.5X0.1875	344.7	73.50	Comp	54.53	83AR	44.344LC3	WIND	83.823	112.896	81.319	0.000	1.442	2	1.000	1.746
D25	D25	SAE	2.5X2.5X0.1875	344.7	124.60	Comp	49.33	84P	34.456LC4	WIND	69.846	112.896	81.319	0.000	1.876	2	1.000	1.746 NG
D26	D26	SAE	2X2X0.1875	344.7	120.43	Comp	73.18	87XY	35.878LC4	WIND	49.029	112.896	81.319	0.000	2.876	2	1.000	1.746 NG
D27	D27	SAE	2X2X0.1875	344.7	98.26	Comp	34.26	88X	16.795LC4	WIND	49.029	112.896	81.319	0.000	3.101	2	1.000	1.746
D28	D28	SAE	2.5X2.5X0.25	344.7	40.51	Comp	23.23	93P	25.184LC4	WIND	110.390	112.896	108.425	0.000	2.706	2	1.000	1.746
D29	D29	SAE	2.5X2.5X0.25	344.7	31.14	Comp	13.58	100P	14.722LC4	WIND	110.390	112.896	108.425	0.000	2.888	2	1.000	1.746
D30	D30	SAE	3X3X0.25	344.7	20.10	Comp	8.82	110P	9.565LC4	WIND	137.497	112.896	108.425	0.000	3.064	2	1.000	1.746
D31	D31	SAE	3X3X0.25	344.7	16.61	Comp	4.04	119P	4.383LC4	WIND	137.497	112.896	108.425	0.000	3.832	2	1.000	1.746
D32	D32	SAE	3X3X0.25	344.7	18.91	Comp	2.48	128P	2.690LC3	WIND	137.497	112.896	108.425	0.000	3.575	2	1.000	1.746
D33	D33	SAE	3X3X0.3125	344.7	22.58	Comp	3.20	131P	3.612LC4	WIND	169.701	112.896	135.531	0.000	3.866	2	1.000	1.746
D34	D34	SAE	3X3X0.3125	344.7	16.05	Comp	10.93	141P	12.341LC3	WIND	169.701	112.896	135.531	0.000	4.268	2	1.000	1.746
D35	D35	SAE	2.5X2.5X0.25	344.7	83.28	Comp	13.35	150P	14.471LC3	WIND	110.390	112.896	108.425	0.000	5.472	2	1.000	1.746
D36	D36	SAE	2X2X0.1875	344.7	1.20	Tens	1.20	227X	0.487LC4	WIND	63.005	56.448	40.659	0.000	1.000	1	1.000	1.746
D37	D37	SAE	2X2X0.1875	344.7	3.76	Comp	3.12	229X	1.268LC3	WIND	63.005	56.448	40.659	0.000	1.000	1	1.000	1.746
D38	D38	SAE	2X2X0.1875	344.7	6.71	Tens	6.71	231P	2.730LC3	WIND	63.005	56.448	40.659	0.000	1.000	1	1.000	1.746
D39	D39	SAE	2X2X0.1875	344.7	9.72	Comp	9.21	233X	3.746LC3	WIND	63.005	56.448	40.659	0.000	1.000	1	1.000	1.746
D40	D40	SAE	2X2X0.1875	344.7	12.73	Tens	12.73	235P	5.176LC3	WIND	63.005	56.448	40.659	0.000	1.000	1	1.000	1.746
D41	D41	SAE	2X2X0.1875	344.7	13.89	Tens	13.89	237X	5.649LC3	WIND	63.005	56.448	40.659	0.000	1.000	1	1.000	1.746
D42	D42	SAE	2X2X0.1875	344.7	14.25	Comp	13.68	239P	5.560LC3	WIND	63.005	56.448	40.659	0.000	1.000	1	1.000	1.746
D43	D43	SAE	2X2X0.1875	344.7	15.00	Tens	15.00	241X	6.097LC3	WIND	63.005	56.448	40.659	0.000	1.000	1	1.000	1.746
D44	D44	SAE	2X2X0.1875	344.7	18.00	Tens	18.00	242Y	7.318LC4	WIND	63.005	56.448	40.659	0.000	1.000	1	1.000	1.746
D45	D45	SAE	2X2X0.1875	344.7	68.65	Comp	56.14	245XY	22.825LC4	WIND	63.005	56.448	40.659	0.000	1.241	1	1.000	1.746
H1	H1	SAE	2X2X0.1875	344.7	53.18	Comp	30.27	154P	19.073LC3	WIND	63.005	112.896	81.319	0.000	1.200	2	1.000	1.746
H2	H2	SAE	2X2X0.1875	344.7	6.50	Comp	4.45	1551P	2.804LC3	WIND	63.005	112.896	81.319	0.000	1.200	2	1.000	1.746
H3	H3	SAE	2X2X0.1875	344.7	5.02	Comp	2.63	1552P	1.655LC4	WIND	63.005	112.896	81.319	0.000	1.200	2	1.000	1.746
H4	H4	SAE	2X2X0.1875	344.7	2.28	Comp	1.40	1543P	0.883LC4	WIND	63.005	112.896	81.319	0.000	1.200	2	1.000	1.746
H5	H5	SAE	2.5X2.5X0.1875	344.7	3.53	Comp	2.61	1554P	2.124LC4	WIND	83.823	112.896	81.319	0.000	1.200	2	1.000	1.746
H6	H6	SAE	2.5X2.5X0.1875	344.7	3.39	Comp	2.58	1555P	2.100LC4	WIND	83.823	112.896	81.319	0.000	1.200	2	1.000	1.746
H7	H7	SAE	2.5X2.5X0.1875	344.7	40.85	Comp	32.71	1546Y	26.598LC3	WIND	83.823	112.896	81.319	0.00				

SILUETA ESFUERZOS-DEF – CARGAS FUTURAS – SIN REFUERZO



EVALUACION ESTRUCTURAL TAC50 + EXTENSION 8 m.



TORRE 50m + ext 8 m. – SAN GIL

TAC50-SANGIL+EXT 8M. -AMZ

HOJA
20 / 29

REV.
0

TORRE 50 m– SAN GIL – SANTANDER
REFORZAMIENTO + DISEÑO DE
EXTENSION

EVALUACION ESTRUCTURAL TAC50 + EXTENSION 8 m.



TORRE 50m + ext 8 m. – SAN GIL

TAC50-SANGIL+EXT 8M. -AMZ

HOJA
21 / 29

REV.
0

RESUMEN DE DISEÑO

Project Name : TORRE 50 m - SAN GIL + EXTENSION - SANTANDER -ACT.
 Project Notes: BTESA - RTVC
 Project File : c:\users\leopoldo.barrera\documents\01- ingenieria & diseNo\pls\work\j. bustos\05- evaluacion torre san gil + extensión\50m-120kmh+ext+ref.tow
 Date run : 12:15:14 p.m. miércoles, 22 de junio de 2016
 by : Tower Version 14.20
 Licensed to : Ing Leopoldo Barrera - Colombia

Successfully performed linear analysis

Member check option: TIA/EIA 222-F
 Connection rupture check: Not Checked
 Crossing diagonal check: ASCE 10 [Alternate Unsupported RLOUT = 1]
 Included angle check: None
 Climbing load check: None
 Redundant members checked with: Actual Force
 Loads from file: c:\users\leopoldo.barrera\documents\01- ingenieria & diseNo\pls\work\j. bustos\05- evaluacion torre san gil + extensión\50m-120kmh-act.eia

*** Analysis Results:

Maximum element usage is 98.13% for Angle "20P" in load case "LC4 WIND 45°-120"

Summary of Joint Support Reactions For All Load Cases:

Load Case	Joint Label	Long. Force (kN)	Tran. Force (kN)	Vert. Force (kN)	Shear Force (kN)	Tran. Moment (kN-m)	Long. Moment (kN-m)	Bending Moment (kN-m)	Vert. Moment (kN-m)	Found. Usage %
LC3 WIND 0°-120	ANP	-43.03	-39.18	-450.96	58.20	-0.98	0.53	1.11	0.09	0.00
LC3 WIND 0°-120	ANX	-29.12	27.26	-291.34	39.89	0.65	0.13	0.66	-0.15	0.00
LC3 WIND 0°-120	ANY	-34.91	-30.25	329.76	46.19	-0.58	0.33	0.67	1.27	0.00
LC3 WIND 0°-120	ANY	-20.58	18.76	170.25	27.85	0.29	-0.10	0.31	-0.57	0.00
LC4 WIND 45°-120	ANP	-56.43	-56.24	-601.04	79.67	-0.94	0.92	1.31	0.09	0.00
LC4 WIND 45°-120	ANX	-7.12	2.76	-59.51	7.63	0.53	-0.29	0.60	-0.37	0.00
LC4 WIND 45°-120	ANY	-46.52	-46.26	480.74	65.61	-0.70	0.68	0.98	-0.08	0.00
LC4 WIND 45°-120	ANY	2.50	-7.92	-62.48	8.31	0.45	-0.69	0.83	2.06	0.00
LC6 WIND 45°-60	ANP	-18.36	-18.29	-194.16	25.91	-0.30	0.29	0.42	0.02	0.00
LC6 WIND 45°-60	ANX	-6.07	4.92	-59.26	7.81	0.20	-0.01	0.20	-0.09	0.00
LC6 WIND 45°-60	ANY	-7.34	-7.26	73.22	10.33	-0.10	0.09	0.13	-0.02	0.00
LC6 WIND 45°-60	ANY	4.87	-6.28	-62.09	7.95	0.04	-0.25	0.25	0.52	0.00

Summary of Joint Support Reactions For All Load Cases in Direction of Leg:

Load Case	Support Joint	Origin Joint	Leg Member	In Residual Shear (kN)	Residual Shear To Leg (kN)	Horizontal Residual Shear To Leg (kN)	Residual Shear To Leg - Long. (kN)	Horizontal Residual Shear To Leg - Tran. (kN)	Total Force (kN)	Total Tran. Force (kN)	Total Vert. Force (kN)
LC3 WIND 0°-120	ANP	75S	35P	454.662	5.836	5.867	5.599	1.754	-43.03	-39.18	-450.96
LC3 WIND 0°-120	ANX	75X	35X	294.001	5.784	5.822	4.944	-3.075	-29.12	27.26	-291.34
LC3 WIND 0°-120	ANY	75XY	35XY	-332.888	8.026	8.072	7.540	2.881	-34.91	-30.25	329.76
LC3 WIND 0°-120	ANY	75Y	35Y	-172.329	7.885	7.938	6.448	-4.629	-20.58	18.76	170.25
LC4 WIND 45°-120	ANP	75S	35P	606.233	9.058	9.120	6.544	6.352	-56.43	-56.24	-601.04
LC4 WIND 45°-120	ANX	75X	35X	59.916	3.081	3.081	2.178	2.178	-7.12	2.76	-59.51
LC4 WIND 45°-120	ANY	75XY	35XY	-485.112	9.119	9.182	6.622	6.360	-46.52	-46.26	480.74
LC4 WIND 45°-120	ANY	75Y	35Y	62.912	3.837	3.837	2.690	2.736	2.50	-7.92	-62.48
LC6 WIND 45°-60	ANP	75S	35P	195.857	3.103	3.125	2.241	2.178	-18.36	-18.29	-194.16
LC6 WIND 45°-60	ANX	75X	35X	59.765	1.145	1.149	1.149	-0.005	-6.07	4.92	-59.26
LC6 WIND 45°-60	ANY	75XY	35XY	-73.927	1.720	1.732	1.264	1.184	-7.34	-7.26	73.22
LC6 WIND 45°-60	ANY	75Y	35Y	62.584	1.162	1.164	0.280	1.130	4.87	-6.28	-62.09

Overturning Moment Summary For All Load Cases:

Load Case	Transverse Moment (kN-m)	Longitudinal Moment (kN-m)	Resultant Moment (kN-m)
LC3 WIND 0°-120	986.135	3838.740	3963.380
LC4 WIND 45°-120	3351.900	3333.533	4727.333
LC6 WIND 45°-60	834.938	817.481	1168.502

EIA Sections Information:

Section Label	Top Z (m)	Bottom Z (m)	Joint Count	Member Count	Top Width (m)	Bottom Width (m)	Gross Area (m²)	Face Adj Factor	Face Ar Adj Factor	Dead Load Factor
1	58.000	54.000	24	68	0.60	0.60	2.40	1.0250	1.0000	1.500
2	54.000	50.800	20	52	0.60	0.60	1.92	1.0250	1.0000	1.500
3	50.800	46.000	28	64	0.60	1.20	4.32	1.0250	1.0000	1.500
4	46.000	42.000	24	44	1.20	1.20	4.80	1.0250	1.0000	1.500
5	42.000	38.000	24	44	1.20	1.20	4.80	1.0250	1.0000	1.500
6	38.000	34.000	24	44	1.20	1.20	4.80	1.0250	1.0000	1.500
7	34.000	30.000	24	44	1.20	1.20	4.80	1.0250	1.0000	1.500
8	30.000	25.000	12	24	1.20	2.03	8.07	1.0500	1.0000	1.500
9	25.000	20.000	16	36	2.03	2.86	12.22	1.1000	1.0000	1.500
10	20.000	14.000	16	36	2.86	3.86	20.15	1.1000	1.0000	1.500
11	14.000	8.000	16	36	3.86	4.85	26.12	1.1000	1.0000	1.500
12	8.000	4.500	12	24	4.85	5.43	18.00	1.1250	1.0000	1.500
13	4.500	0.000	12	12	5.43	6.18	26.13	1.1250	1.0000	1.500

EVALUACION ESTRUCTURAL TAC50 + EXTENSION 8 m.



TORRE 50m + ext 8 m. – SAN GIL

TAC50-SANGIL+EXT 8M. -AMZ

HOJA
22 / 29

REV.
0

*** Overall summary for all load cases - Usage = Maximum Stress / Allowable Stress
Printed capacities do not include EIA allowable stress increase for wind load cases.
Printed capacities do not include the strength factor entered for each load case.
The Group Summary reports on the member and load case that resulted in maximum usage
which may not necessarily be the same as that which produces maximum force.

Group Summary (Compression Portion):

Group Label	Group Desc.	Angle Type	Angle Size	Steel Strength (MPa)	Max Usage %	Usage Control	Max Use In Comp. %	Comp. Member	Comp. Force (kN)	Comp. Control Load Case	Capacity (kN)	L/r Connect.	Comp. Shear Capacity (kN)	Comp. Bearing Capacity (kN)	RLX	RLY	RLZ	L/r	KL/r	Length Member (m)	Curve No.	No. Bolts	Of Comp.
M0	M0	SAE	2.5X2.5X0.25	344.7	21.67	Comp	21.67	220P	-25.235LC4	WIND	116.439	903.167	433.700	1.000	1.000	1.000	64.15	64.15	0.800	1	8		
M1A	M1A	SAE	2.5X2.5X0.25	344.7	65.66	Comp	65.66	224P	-76.455LC4	WIND	116.439	903.167	433.700	1.000	1.000	1.000	64.15	64.15	0.800	1	0		
M1	M1	PAE	2.5X0.25 + 2.5X0.25 (X)	344.7	43.60	Comp	43.60	5P	-116.019LC4	WIND	266.086	903.167	867.401	1.000	1.000	1.000	47.79	47.79	0.800	1	8		
M2	M2	PAE	3X0.3125 + 3X0.3125 (X)	344.7	53.05	Comp	53.05	10P	-221.714LC4	WIND	417.941	903.167	1084.251	1.000	1.000	1.000	39.53	39.53	0.800	1	8		
M3	M3	PAE	3X0.25 + 4X0.375 (X)	344.7	68.97	Comp	68.97	15P	-356.649LC4	WIND	517.138	903.167	1084.251	1.000	1.000	1.000	34.46	34.46	0.800	1	8		
M4	M4	PAE	3X0.25 + 4X0.375 (X)	344.7	98.13	Comp	98.13	20P	-507.446LC4	WIND	517.138	903.167	1084.251	1.000	1.000	1.000	34.46	34.46	0.800	1	8		
M5	M5	PAE	4X0.375 + 4X0.375 (X)	344.7	97.32	Tens	95.94	25P	-575.865LC4	WIND	704.479	1354.750	1952.676	1.000	1.000	1.000	29.71	29.71	0.800	1	12		
M6	M6	PAE	6X0.625 + 4X0.375 (X)	344.7	69.06	Comp	69.06	27P	-623.709LC4	WIND	1168.070	903.167	1734.802	0.500	0.500	0.500	36.97	36.97	2.517	1	8		
M7	M7	SAE	6X6X0.625	344.7	70.36	Comp	70.36	29P	-568.539LC4	WIND	808.048	903.167	1084.251	0.500	0.500	0.500	41.99	41.99	2.517	1	8		
M8	M8	SAE	6X6X0.625	344.7	74.07	Comp	74.07	31P	-550.083LC4	WIND	742.672	903.167	1084.251	0.500	0.500	0.500	55.43	55.43	3.323	1	8		
M9	M9	SAE	6X6X0.625	344.7	73.41	Comp	73.41	33P	-563.912LC4	WIND	768.205	903.167	1084.251	0.500	0.500	0.500	50.39	50.39	3.021	1	8		
M10	M10	SAE	6X6X0.625	344.7	70.42	Comp	70.42	34P	-577.929LC4	WIND	820.725	903.167	1084.251	0.333	0.333	0.333	39.15	39.15	3.524	1	8		
M11	M11	SAE	6X6X0.625	344.7	75.59	Comp	75.59	35P	-580.887LC4	WIND	768.454	903.167	1084.251	0.333	0.333	0.333	50.34	50.34	4.531	1	8		
D1	D1	SAE	2X2X0.1875	344.7	34.31	Comp	34.31	37AR	-8.902LC3	WIND	25.943	112.896	81.319	1.000	1.000	1.000	144.11	134.83	1.442	6	2		
D2	D2	SAE	2X2X0.1875	344.7	53.90	Comp	53.90	39P	-13.984LC3	WIND	25.943	112.896	81.319	1.000	1.000	1.000	144.11	134.83	1.442	6	2		
D3	D3	SAE	2X2X0.1875	344.7	59.38	Comp	59.38	41AR	-15.405LC3	WIND	25.943	112.896	81.319	1.000	1.000	1.000	144.11	134.83	1.442	6	2		
D4	D4	SAE	2X2X0.1875	344.7	58.21	Comp	58.21	43P	-15.101LC3	WIND	25.943	112.896	81.319	1.000	1.000	1.000	144.11	134.83	1.442	6	2		
D5	D5	SAE	2X2X0.1875	344.7	63.50	Comp	63.50	45AR	-16.475LC3	WIND	25.943	112.896	81.319	1.000	1.000	1.000	144.11	134.83	1.442	6	2		
D6	D6	SAE	2X2X0.1875	344.7	71.13	Comp	71.13	47P	-18.454LC3	WIND	25.943	112.896	81.319	1.000	1.000	1.000	144.11	134.83	1.442	6	2		
D7	D7	SAE	2X2X0.1875	344.7	76.82	Comp	76.82	49AR	-19.929LC3	WIND	25.943	112.896	81.319	1.000	1.000	1.000	144.11	134.83	1.442	6	2		
D8	D8	SAE	2X2X0.1875	344.7	77.51	Comp	77.51	51P	-20.108LC3	WIND	25.943	112.896	81.319	1.000	1.000	1.000	144.11	134.83	1.442	6	2		
D9	D9	SAE	2X2X0.1875	344.7	86.21	Comp	86.21	53AR	-22.366LC3	WIND	25.943	112.896	81.319	1.000	1.000	1.000	144.11	134.83	1.442	6	2		
D10	D10	SAE	2X2X0.1875	344.7	88.44	Comp	88.44	55P	-22.945LC3	WIND	25.943	112.896	81.319	1.000	1.000	1.000	144.11	134.83	1.442	6	2		
D11	D11	SAE	2X2X0.1875	344.7	96.08	Comp	96.08	57AR	-24.926LC3	WIND	25.943	112.896	81.319	1.000	1.000	1.000	144.11	134.83	1.442	6	2		
D12	D12	DAE	2X2X0.1875	344.7	24.43	Comp	24.43	59P	-25.640LC3	WIND	104.947	112.896	162.638	1.000	1.000	1.000	92.03	92.03	1.442	1	2		
D13	D13	DAE	2X2X0.1875	344.7	25.99	Comp	25.99	61AR	-27.271LC3	WIND	104.947	112.896	162.638	1.000	1.000	1.000	92.03	92.03	1.442	1	2		
D14	D14	DAE	2X2X0.1875	344.7	25.41	Comp	25.41	63P	-26.667LC3	WIND	104.947	112.896	162.638	1.000	1.000	1.000	92.03	92.03	1.442	1	2		
D15	D15	DAE	2X2X0.1875	344.7	26.58	Comp	26.58	65AR	-27.899LC3	WIND	104.947	112.896	162.638	1.000	1.000	1.000	92.03	92.03	1.442	1	2		
D16	D16	SAE	2.5X2.5X0.1875	344.7	61.08	Comp	61.08	67P	-27.816LC3	WIND	45.536	112.896	81.319	1.000	1.000	1.000	114.71	114.71	1.442	1	2		
D17	D17	SAE	2.5X2.5X0.1875	344.7	85.16	Comp	85.16	69AR	-38.781LC3	WIND	45.536	112.896	81.319	1.000	1.000	1.000	114.71	114.71	1.442	1	2		
D18	D18	SAE	2.5X2.5X0.1875	344.7	76.44	Comp	76.44	70P	-34.808LC4	WIND	45.536	112.896	81.319	1.000	1.000	1.000	114.71	114.71	1.442	1	2		
D19	D19	SAE	2.5X2.5X0.1875	344.7	87.57	Comp	87.57	73AR	-39.875LC3	WIND	45.536	112.896	81.319	1.000	1.000	1.000	114.71	114.71	1.442	1	2		
D20	D20	SAE	2.5X2.5X0.1875	344.7	70.14	Comp	70.14	74P	-31.941LC4	WIND	45.536	112.896	81.319	1.000	1.000	1.000	114.71	114.71	1.442	1	2		
D21	D21	SAE	2.5X2.5X0.1875	344.7	90.14	Comp	90.14	77AR	-41.047LC3	WIND	45.536	112.896	81.319	1.000	1.000	1.000	114.71	114.71	1.442	1	2		
D22	D22	SAE	2.5X2.5X0.1875	344.7	90.67	Comp	90.67	78P	-41.287LC4	WIND	45.536	112.896	81.319	1.000	1.000	1.000	114.71	114.71	1.442	1	2		
D23	D23	SAE	2.5X2.5X0.1875	344.7	96.47	Comp	96.47	81AR	-43.930LC3	WIND	45.536	112.896	81.319	1.000	1.000	1.000	114.71	114.71	1.442	1	2		
D24	D24	DAE	2.5X2.5X0.1875	344.7	38.59	Comp	38.59	83P	-33.486LC4	WIND	45.536	112.896	81.319	1.000	1.000	1.000	114.71	114.71	1.442	1	2		
D25	D25	DAE	2.5X2.5X0.1875	344.7	38.59	Comp	38.59	84AR	-43.569LC4	WIND	126.950	112.896	162.638	1.000	1.000	1.000	94.94	94.94	1.876	1	2		
D26	D26	DAE	2X2X0.1875	344.7	61.21	Comp	61.21	87P	-33.955LC4	WIND	55.470	112.896	162.638	0.750	0.500	0.500	137.66	130.86	2.876	6	2		
D27	D27	DAE	2X2X0.1875	344.7	46.87	Comp	46.87	88Y	-23.560LC4	WIND	50.271	112.896	162.638	0.750	0.500	0.500	148.39	137.46	3.101	6	2		
D28	D28	SAE	2.5X2.5X0.25	344.7	39.88	Comp	39.88	97P	-18.255LC4	WIND	45.778	112.896	108.425	1.000	0.500	0.500	138.55	131.41	2.706	6	2		
D29	D29	SAE	2.5X2.5X0.25	344.7	31.02	Comp	31.02	104P	-13.041LC4	WIND	42.044	112.896	108.425	1.000	0.500	0.500	147.83	137.12	2.888	6	2		
D30	D30	SAE	3X3X0.25	344.7	20.27	Comp	20.27	106P	-12.223LC3	WIND	60.290	112.896	108.425	1.000	0.500	0.500	129.69	125.96	3.064	6	2		
D31	D31	SAE	3X3X0.25	344.7	16.81	Comp	16.81	120P	-7.546LC3	WIND	44.899	112.896	108.425	1.000	0.500	0.500	162.21	145.96	3.832	6	2		
D32	D32	SAE	3X3X0.25	344.7	18.13	Comp	18.13	124P	-8.939LC3	WIND	49.316	112.896	108.425	1.000	0.500	0.500	151.33	139.27	3.575	6	2		
D33	D33	SAE	3X3X0.3125	344.7	22.15	Comp	22.15	135P	-11.999LC3	WIND	54.177	112.896	135.531	1.000	0.500	0.500	165.09	147.73	3.866	6	2		
D34	D34	SAE	3X3X0.3125	344.7	16.08	Comp	16.08	139P	-7.586LC4	WIND	47.187	112.896	135.531	1.000	0.330	0.330	182.27	158.29	4.268	6	2		
D35	D35	SAE	2.5X2.5X0.25	344.7	83.40	Comp	83.40	146P	-13.812LC4	WIND	16.561	112.896	108.425	1.000	0.330	0.330	280.12	218.48	5.472	6	2		
D36	D36	SAE	2X2X0.1875	344.7	1.20	Tens	0.41	227P	-0.168LC4	WIND	46.501	56.448	40.659	1.000	1.000	1.000	99.92	99.92	1.000	1	1		
D37	D37	SAE	2X2X0.1875	344.7	3.77	Tens	6.19	229Y	-1.531LC3	WIND	46.501	56.448	40.659	1.000	1.000	1.000	99.92	99.92	1.000	1	1		
D38	D38	SAE	2X2X0.1875	344.7	6.72	Tens	6.19	231XY	-2.518LC3	WIND	46.501	56.448	40.659	1.000	1.000	1.000	99.92	99.92	1.000	1	1		
D39	D39	SAE	2X2X0.1875	344.7	9.72	Tens	9.72	233Y	-3.951LC3	WIND	46.501	56.448	40.659	1.000	1.000	1.000	99.92	99.92	1.000	1	1		
D40	D40	SAE	2X2X0.1875	344.7	12.73	Tens	12.15	235XY	-4.942LC3	WIND	46.501	56.448	40.659	1.000	1.000	1.000	99.92	99.92	1.000	1	1		
D41	D41	SAE	2X2X0.1875	344.7	13.98	Tens	13.16	237Y	-5.349LC3	WIND	46.501	56.448	40.659	1.000	1.000	1.000	99.92	99.92	1.000	1	1		
D42	D42	SAE	2X2X0.1875	344.7	14.31	Comp	14.31	239XY	-5.820LC3	WIND	46.501	56.448	40.659	1.000									

TORRE 50 m + EXTENSION 8 m. –
SAN GIL - SANTANDER
CIMENTACION

EVALUACION ESTRUCTURAL TAC50 + EXTENSION 8 m.



TORRE 50m + ext 8 m. – SAN GIL

TAC50-SANGIL+EXT 8M. -AMZ

HOJA
24 / 29

REV.
0

VALIDACION CIMENTACION
TORRE CUADRADA H = 50 m + EXTE 8 m. - 120 KM/H
TORRE R.B. SAN GIL
SAN GIL (SANTANDER)

1. PARAMETROS DE DISEÑO

Esfuerzo admisible del suelo	(QADM)=	83 kPa
Angulo de fricción Interna	(ANF)=	32 °
Angulo del cono de arranque	(AN)=	30 °
Coefficiente de presión pasiva	(Kp)=	3,25
Peso unitario del concreto	(GC)=	24 kN/m³
Peso unitario del suelo	(GS)=	16 kN/m³
Peso unitario del relleno	(GREL)=	16 kN/m³
Esfuerzo de fluencia del acero, fy	(FY)=	410 MPa
Resistencia del concreto, fc	(FC)=	20 MPa

2. CARGAS DE TRABAJO

Hip.	Carga Arranque (kN)	Carga Compres. (kN)	Carga Long. (kN)	Carga Transv. (kN)	tan(a)= 0,0000		
					x (kN)	y (kN)	z (kN)
1		601,04	56,43	56,24	-56,43	-56,24	-601,04
2	480,74		46,52	46,26	-46,52	-46,26	480,74

3. CARGAS DE DISEÑO

Hip.	Carga Arranque (kN)	Carga Compres. (kN)	Carga Long. (kN)	Carga Transv. (kN)	x (kN)	y (kN)	z (kN)
1		901,56	84,65	84,36	-84,65	-84,36	-901,56
2	721,11		69,78	69,39	-69,78	-69,39	721,11

4. ANALISIS CON CARGAS DE TRABAJO

Altura del pedestal sobre el suelo	(AST)=	0,50 m
Lado de la columna	(A)=	0,70 m
Espesor mínimo de la zapata	(T)=	0,50 m
Pendiente cara superior de la zapata	(AP)=	0 °
Increm.espesor zapata en el pedestal	(P)=	0,00 m
Longitud de la columna	(C)=	1,70 m
Lado de la zapata	(B)=	4,50 m
Profundidad de la cimentación	(D)=	1,70 m
Bisel de la zapata	(db)=	0,00 m
Recubrimiento del acero	(REC)=	0,07 m

VOLUMENES DE OBRA

Volumen de concreto	(VZ)=	10,96 m³
Volumen de relleno	(VREL)=	23,71 m³
Volumen de excavación	(VEXC)=	34,43 m³

EVALUACION ESTRUCTURAL TAC50 + EXTENSION 8 m.



TORRE 50m + ext 8 m. – SAN GIL

TAC50-SANGIL+EXT 8M. -AMZ

HOJA
25 / 29

REV.
0

VALIDACION CIMENTACION
TORRE CUADRADA H = 80 m + EXTE 8 m. - 120 KMH
TORRE R.S.L. SAN GIL
SAN GIL (SANTANDER)

ANALISIS DE ESTABILIDAD

Volúmen del cono de arranque	(VC) =	8,09 m³
Peso total del cono+relleno+cimiento	(WC) =	771,8 kN
Hip. de carga crítica arrancamiento	(Hc) =	2
Factor de seguridad al arranque	(K) =	1,61
Hipótesis de carga crítica vuelco	(Hv) =	2
Prof.bloque presión pasiva transvers.	(Ht) =	1,67 m
Prof.bloque presión pasiva longitudinal	(Hl) =	1,67 m
Momento de vuelco transversal	(MVT) =	1183,4 kN.m
Momento de vuelco longitudinal	(MVL) =	1184,0 kN.m
Momento estabilizador transversal	(MESTT) =	1750,9 kN.m
Momento estabilizador longitudinal	(MESTL) =	1750,9 kN.m
Factor de seguridad al vuelco	(K2) =	1,63
Hipótesis de carga crítica	(Hc) =	1
Prof.bloque presión pasiva transvers.	(Ht) =	1,47 m
Prof.bloque presión pasiva longitudinal	(Hl) =	1,47 m
Momento transversal en la base	(MTs) =	87,2 kN.m
Momento longitudinal en la base	(MLs) =	88,8 kN.m
Carga vertical total	(FVs) =	1243,4 kN
Máximo esfuerzo actuante	(QACT) =	46 kPa

5. ANALISIS CON CARGAS DE DISEÑO

Hipótesis de carga crítica	(Hc) =	1
Prof.bloque presión pasiva transvers.	(Ht) =	1,56 m
Prof.bloque presión pasiva longitudinal	(Hl) =	1,56 m
Momento transversal en la base	(MTs) =	130,4 kN.m
Momento longitudinal en la base	(MLs) =	137,9 kN.m
Carga vertical total	(FVs) =	1543,9 kN
Máximo esfuerzo actuante	(QMAX) =	67 kPa
Esfuerzo actuante promedio	(QMED) =	49 kPa

6. DISEÑO CONCRETO REFORZADO

Esfuerzo de punzonamiento	(PUNZ) =	0,56 MPa
Esfuerzo de punzonamiento admisible	(PUNMO) =	1,46 MPa
Esfuerzo cortante	(CORT) =	0,27 MPa
Esfuerzo cortante admisible	(CORMO) =	0,74 MPa

MOMENTO DISEÑO A LA COMPRESION

Momento de diseño	(MOM) =	546,2 kN.m
Área de acero requerida, As	(AST) =	52,8 cm²

30#5

MOMENTO DISEÑO AL ARRANQUE

Hip. de carga crítica arrancamiento	(Hc) =	2
Momento de diseño	(MOM) =	188,3 kN.m
Esfuerzo de tracción sin refuerzo	(FCT) =	1,4 MPa
Esfuerzo admisible a tracción	(FTMAX) =	1,6 MPa
Área de acero requerida, As	(AST) =	0,0 cm²

30#5

COLUMNA

Hip. carga crítica-flexo-tracción	(Ht) =	2
Área de acero requerida por tracción	(ATEN) =	17,59 cm²
Área por tracción en cada cara	(ATCA) =	4,40 cm²
Área requerida por flexión	(AREQ) =	6,52 cm²
Área total requerida por cara	(ACAR) =	10,92 cm²
Área total de acero requerida	(ATOT) =	30,64 cm²

12#7

EVALUACION ESTRUCTURAL TAC50 + EXTENSION 8 m.



TORRE 50m + ext 8 m. – SAN GIL

TAC50-SANGIL+EXT 8M. -AMZ

HOJA
26 / 29

REV.
0

CONCLUSIONES:

La torre de 50 metros instalada en sitio San Gil - Santander, en el estado actual mas su extension de 8 m. y después del análisis con las antenas instaladas:

1. La estructura metálica en las condiciones de trabajo con las cargas actuales mas las antenas nuevas, NO CUMPLE por esfuerzos y deformaciones; El elemento más esforzado está trabajando al **205.52%**, referido al límite fluencia, fallan los montantes M02, M03, M04, M05 y los Diagonales D13, D14 y D15, marcados en rojo en la silueta.
2. El análisis estructural se hace considerando que los elementos que conforman la estructura están en buen estado.
3. La deflexión máxima en el extremo superior de la torre, para cargas de trabajo, con viento de 60 km/hes 0.107 m, es decir 0.1057 ° menor a 0.5°.
4. Se propone un refuerzo para los elementos M01 con L2-1/2"x1/4", M02 con L3"x5/16", M03 con L3"x1/4", M04 con L3"x1/4", M05 con L4"x3/8", M06 con L4"x3/8" en X. Igualmente se reforzaran los diagonales D12, D13, D14, D15, D26 y D27 reforzandolo con doble Angulo de igual especificacion. Se debiera modificar la conexion entre montante 5 y montante 6 implementando 8 tornillos de 5/8" ASTM A-325 T1 con eclisa interna en L6"x5/8" para que la conexion trabaje a Corte Doble.
Peso aprox. del reforzamiento = 1425 kg.
Peso aprox. de la Extension = 630 kg.
5. La cimentación, según el informe de campo, está compuesta por zapatas cuadradas de 1.29m. de lado, con pedestales de 0.50x0.50 a una profundidad de 2.80 metros, sin vigas de amarre, con suelo $q_a=0.85 \text{ kg/cm}^2$ y según la verificación, la cimentación es insuficiente y por ende NO cumple por esfuerzos para las cargas tanto actuales como futuras de la torre. Se propone hacer un reforzamiento mediante la construcción de placas en cada pata, de 4.50x4.50 m, con espesor de 0.50m y a una profundidad de 1.70 m., igualmente ampliar el pedestal a 0.70x0.70 m., Se debiera construir cuatro (4) vigas de amarre de 0.50 x 0.50 m. entre pedestals. Las cantidades de obra son 47 m3 de concreto de 210 kg/cm2 y 3950 kg de acero de refuerzo.

EVALUACION ESTRUCTURAL TAC50 + EXTENSION 8 m.

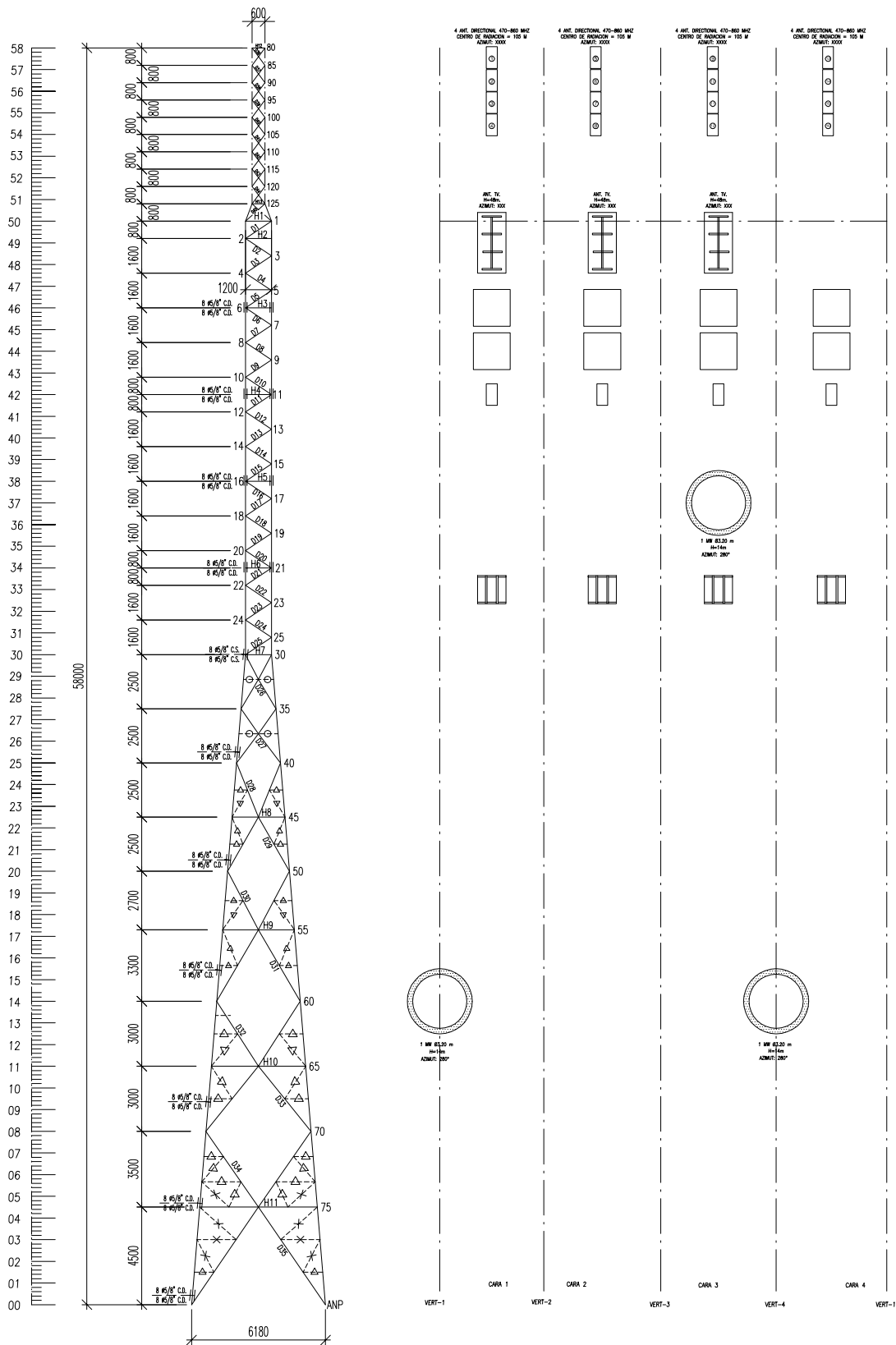


TORRE 50m + ext 8 m. – SAN GIL

TAC50-SANGIL+EXT 8M. -AMZ

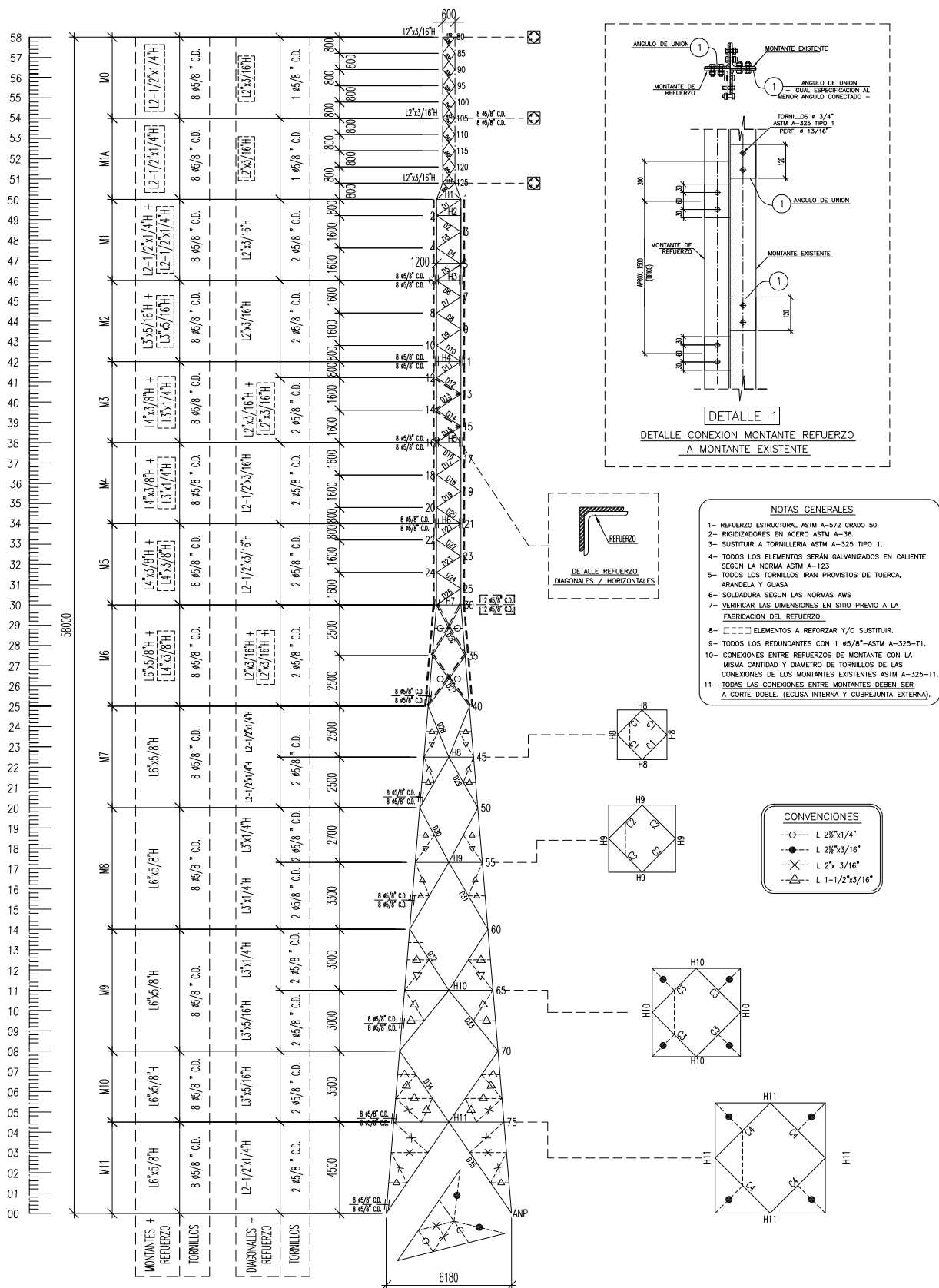
HOJA
27 / 29

REV.
0



E.B SAN GIL – SANTANDER
TORRE CUADRADA AUTOSOPORTADA 50 m.+EXT. 8m.
CONTIENE:
CARGAS EXISTENTES + PROYECTADAS

REALIZO:
DIBUJO:
FECHA:
ESCALA:



E.B SAN GIL - SANTANDER
TORRE CUADRADA AUTOSOPORTADA 50 m.+EXT. 8m.
CONTIENE:
REFUERZO ESTRUCTURAL Y DISEÑO DE EXTENSION

REALIZO:
DIBUJO:
FECHA:
ESCALA:

**CELDA DE COMUNICACIONES
REVISIÓN CIMENTACIÓN ESTACIÓN RTVC SAN GIL**

**CERRO ALTO GUARIGUA
SAN GIL SANTANDER - COLOMBIA**



***ESTUDIO MECÁNICA DE SUELOS
SUELOS Y CIMENTACIONES***



JVS IAN.SAS
INGENIERÍA, CONSULTORÍA Y CONSTRUCCIÓN

BOGOTÁ, D.C., MAYO DE 2016

Telefax 684 1900 / 312 498 2320 Bogotá - Colombia
e-mail: jvsiansas@yahoo.com

CONTENIDO

Pag.

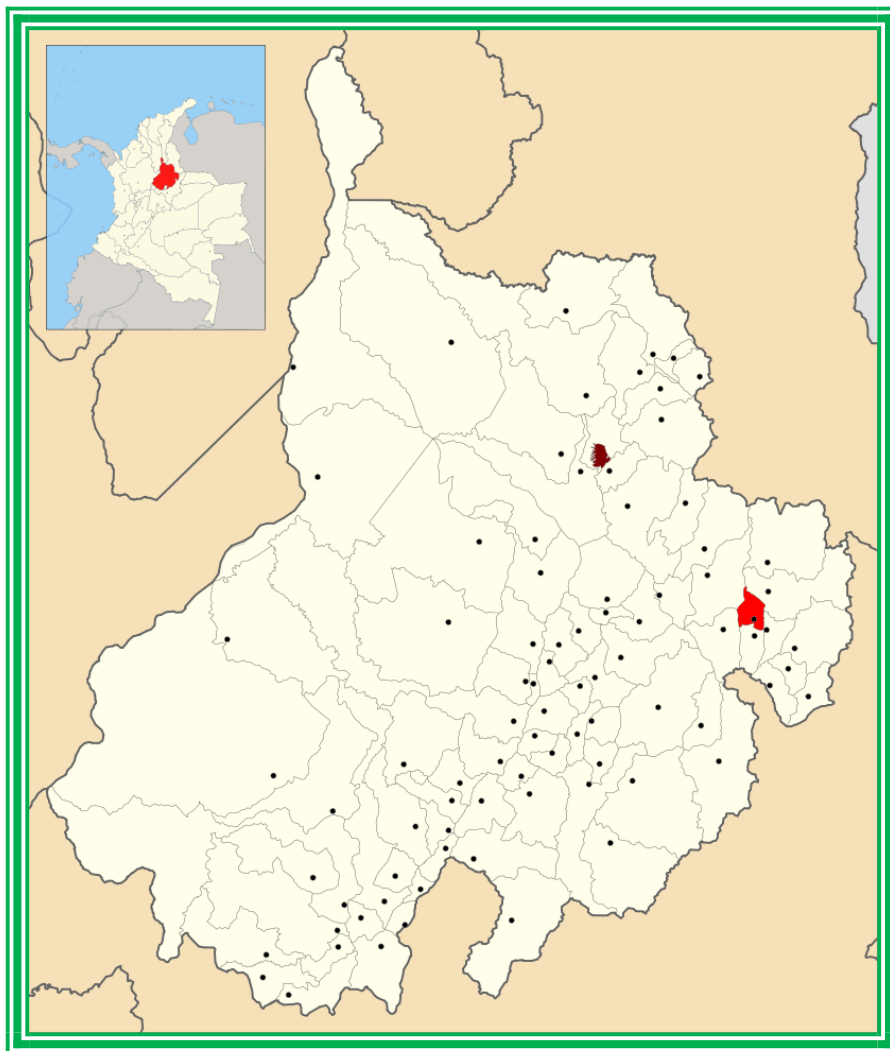
1.	INTRODUCCION	3
2.	PROCESO DE EXPLORACIÓN.....	4
3.	LIMITACIONES.....	6

ANEXOS

ESTUDIO DE VERIFICACIÓN DE CIMENTACIÓN **CELDA ESTACIÓN RTVC SAN GIL**

1. INTRODUCCIÓN

La falta de información sobre torres de comunicaciones existentes, sin planos de geometría, tipo y armado de cimentación, requiere que a través de exploración mediante regatas en el concreto se establezca el refuerzo y mediante excavación se determine la profundidad y tipo de cimentación.



2. PROCESO DE EXPLORACIÓN

Una vez llegado al sitio, se procede con la limpieza del lugar de trabajo, es decir; al retiro de gravas o pastos para posterior reutilización y con el fin de dejar el sitio lo más próximo a como se encontró. Luego, se selecciona una de los soportes o apoyos de la torre estación con el fin de excavar hasta encontrar la base de su cimentación, determinando tipo y geometría. Esta excavación permite hallar el suelo sobre la cual fue cimentada la torre de comunicaciones, y se aprovecha para hallar datos importantes con la manipulación apropiada del penetró metro y veleta de bolsillo. Mediante la utilización de pulidora, cincel, maceta, brocha y detector manual de hierros se ubican refuerzos con el fin de establecer diámetros y separación entre los mismos. Una vez se tiene estos datos, se procede a reparar la regata con mortero. Se complementa toda esta información con la toma de las restantes dimensiones y además, la información sobre calidad de concreto mediante la utilización del esclerómetro.

Antes de retirarse del lugar, se tapa la excavación compactándola por capas y dejando el lugar como se encontró. Se localiza el sitio mediante GPS.



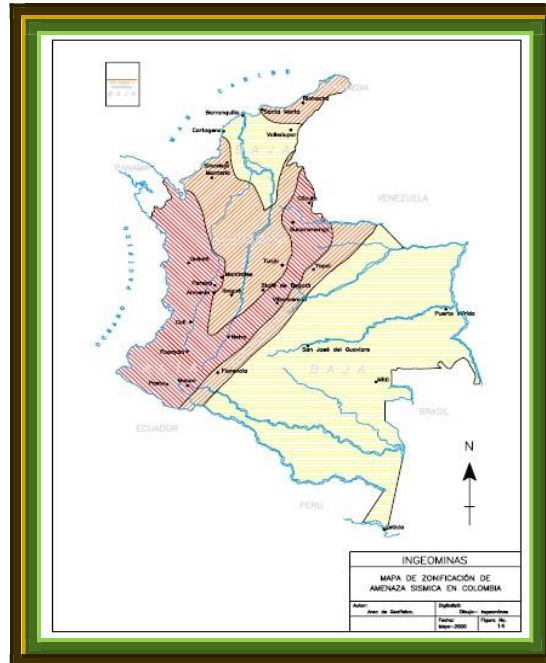
Su localización geográfica:

Latitud:	05°35.527´
Longitud:	073°10.938´
Altura:	1879 msnm

De la excavación a uno de los costados de la torre de comunicaciones identificada como estación San Gil ubicada en cerro Guarigua del municipio de San Gil Santander Colombia, se encontró que esta soportada sobre cuatro (04) zapatas aisladas de la cual nace un pedestal en cada una. La zapata tiene una dimensión de 1.74*1.74 m, y una altura de 0.45 m. De la regata a la zapata se encontró que tiene doble parrilla con refuerzo $\phi = 1/2"$, la separación promedio entre éstas varillas es de 0.25 m, con resistencia media del concreto de +/- 3109 psi (219 Kg/cm²), al pedestal de 0.50*0.50m por una altura total de 2.10m, se encontró refuerzo de $\phi = 1/2"$, la separación promedio entre éstas varillas es de 0.20 m, con estribos $\phi = 3/8"$ cada 0.30m y con resistencia media del concreto de +/- 3109 psi (219 Kg/cm²). Sobre la zapata se encuentra otra zapata de menor dimensión de 0.84*0.84*0.25 con refuerzo $\phi = 1/2"$, la separación promedio entre éstas varillas es de 0.25 m, aproximadamente.

Todo el proceso de excavación y exploración de la cimentación se registró mediante secuencias fotográficas.

Con la NSR-10 Decreto 926, decreto 2525 de 2010 y el que lo modifica decreto 092 del 17 de enero de 2011, a este predio se le ubica en zona de riesgo sísmico alto. El perfil del subsuelo corresponde al tipo D, clasificando la zona presente como de riesgo sísmico alto.



Coeficiente que representa la aceleración pico efectiva, para diseño;
Coeficiente que representa la velocidad horizontal pico efectiva;

$A_a = 0.20$
 $A_v = 0.25$



Coeficiente que representa la aceleración pico efectiva reducida; $A_e = 0.09$
 Coeficiente que representa la aceleración pico efectiva, umbral de daño; $A_d = 0.06$
 Coeficiente de ampliación en zona de periodos cortos, efectos de sitio; $F_a = 1.40$
 Coeficiente de ampliación en zona de periodos medios de espectro; $F_v = 1.90$

3. LIMITACIONES.

Los análisis de ingeniería, conclusiones y recomendaciones que en éste informe se presentan, se fundamentan en la información obtenida de los trabajos del sitio del proyecto y sus respectivos ensayos en laboratorio. Si durante el proceso de construcción del proyecto se encuentran condiciones diferentes a las aquí consideradas como típicas, deberá informar para introducir los ajustes del caso. Torre de comunicaciones identificada como estación San Gil ubicada en cerro Guarigua del municipio de San Gil Santander Colombia.

Prohibida su reproducción total o parcial sin autorización previa y por escrito del ingeniero de suelos quien firma el presente informe.

Bogotá, D.C., Mayo de 2016.
 Telefax 684 1900 Bogotá D.C
 312 498 2320

JVS IAN.SAS

Ingeniería, Consultoría y Construcción
LUIS ROBERTO ROSAS MARIN
 M. P 25202-70230 CND
 ING CIVIL ESP GEOTECNIA
 Representante legal

ANEXO
ESQUEMA DE LA INVESTIGACIÓN
PLANO

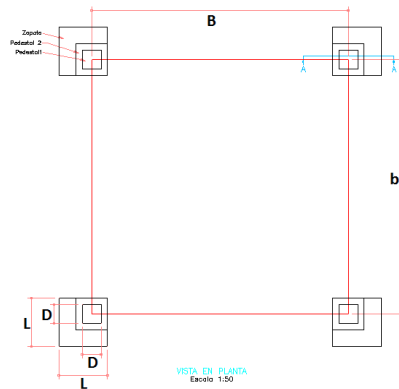


INFORMACION GEOMETRICA DE CIMENTACION

I. INFORMACIÓN GENERAL DEL SITIO

Site ID : _____ Nombre : _____ ESTACIÓN SANGIL
Dirección : _____ CERRO ALTO GUARIGUA SAN GIL SANTANDER Ciudad : _____ SANGIL
REPÚBLICA : _____ COLOMBIA DEPARTAMENTO : _____ SANTANDER
Longitud : _____ Latitud : _____ 05°35,527' Altura sobre el nivel del mar: 1879 msnm
Tipo Estructura Self-supported Tower Altura : _____ Geometría de Torre : _____ Square
Abertura en Base : 6,80 m

III. GEOMETRIA Y ARMADO DE CIMENTACION



SUELOS, CONCRETO Y PAVIMENTOS		INDICE ESCLEROMETRICO			
		1	2	3	4
Localizacion	Pedestal	Zapata			
Altura (m.)					
EJE					
Angulo	0	0			
Material	CONCRETO	CONCRETO			
Lectura 1	28,00	28,00			
Lectura 2	32,00	24,00			
Lectura 3	30,00	28,00			
Lectura 4	32,00	25,00			
Lectura 5	28,00	28,00			
Lectura 6	30,00	26,00			
Lectura 7	28,00	24,00			
Lectura 8	28,00	26,00			
Lectura 9	26,00	28,00			
Lectura 10	28,00	28,00			
Lectura 11	34,00	26,00			
Lectura 12	28,00	28,00			
Lectura 13	30,00	28,00			
Lectura 14	30,00	26,00			
Lectura 15	30,00	26,00			
Lectura 16	32,00	26,00			
Lectura 17	28,00	28,00			
Lectura 18	34,00	26,00			
Lectura 19	28,00	28,00			
Lectura 20	30,00	34,00			
MODA	28,00	28,00			
RESISTENCIA kg/cm ²	219	219			
RESISTENCIA (psi)	3109	3109			

TIPO DE CIMENTACIÓN :

Zapatas Aisladas

Geometría

L = 1,290 m
B = 6,800 m
b = 6,800 m
h = 0,500 m
Df = 2,800 m
H = 0,450 m

Dados

D = 0,50 m
Vars. en Dado : 8 # 4 @ 0,20 m
Flejes #2 @ 0,30 m

Acero de Refuerzo

Parrilla # 4 @ 0,15 m ambos sentidos
4 @ 0,15 m ambos sentidos

Capacidad de carga en suelo

q = 8,52 ton/m²

Full this format according to foundation shape (isolated, slab, etc:)

SUELOS, CONCRETO Y PAVIMENTOS	INDICE ESCLEROMETRICO
-------------------------------	------------------------------

PROYECTO: ESTACIÓN SAN GIL LOCALIZACIÓN: CERRO ALTO GUARIGUA SAN GIL SANTANDER CLIENTE: _____ DESCRIPCIÓN: _____	O. T. No : _____ CONSEC : _____ FECHA ENSAYO: 23-may-16 <div style="text-align: right;">HOJA 1 DE 1</div>
-------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------

	1	2	3	4
Localización	Pedestal	Zapata		
Altura (m.)				
Lado				
Angulo	0	0		
Material	CONCRETO	CONCRETO		
Lectura 1	28,00	28,00		
Lectura 2	32,00	24,00		
Lectura 3	30,00	28,00		
Lectura 4	32,00	25,00		
Lectura 5	28,00	28,00		
Lectura 6	30,00	26,00		
Lectura 7	28,00	24,00		
Lectura 8	28,00	26,00		
Lectura 9	26,00	28,00		
Lectura 10	28,00	28,00		
Lectura 11	34,00	26,00		
Lectura 12	28,00	28,00		
Lectura 13	30,00	28,00		
Lectura 14	30,00	26,00		
Lectura 15	30,00	26,00		
Lectura 16	32,00	26,00		
Lectura 17	28,00	28,00		
Lectura 18	34,00	26,00		
Lectura 19	28,00	28,00		
Lectura 20	30,00	34,00		
MODA	28,00	28,00		
RESISTENCIA kg/cm²	219	219		
RESISTENCIA (psi)	3109	3109	#i\VALOR!	#i\VALOR!

OBSERVACIONES

EJECUTÓ

REVISÓ

CONTRATO

ANEXO
COPIA TARJETA PROFESIONAL

Bogotá, D.C., Mayo de 2016.

Señores
PLANEACIÓN MUNICIPAL
DEPARTAMENTO DE INGENIERÍA
SAN GIL SANTANDER - COLOMBIA

Referencia: REVISIÓN CELDA DE COMUNICACIONES
ESTACIÓN SAN GIL
Dirección: CERRO GUARIGUA EN SAN GIL SANTANDER COLOMBIA

Asunto: **MEMORIAL DE RESPONSABILIDAD.**

Yo, LUIS ROBERTO ROSAS MARÍN, Ingeniero Civil, identificado con la Cédula de Ciudadanía No. 7'222.548 con matrícula profesional No. 25202 – 70230 del Consejo Profesional de Ingeniería y Arquitectura de Cundinamarca, en representación de JVS IAN.SAS, certifico que he realizado el informe de revisión de cimentación correspondiente al predio de la referencia y la respectiva toma de muestras, ensayos y análisis de laboratorio.

Que todo el análisis y estudios presentados han sido elaborados siguiendo las normas contenidas en las Normas Colombianas de Diseño y Construcción Sismo Resistente NSR10 (Decreto 926 de 2010 NSR10 y el Decreto 092 del 17 de Enero de 2011).

Cordialmente,



JVS IAN.SAS

Ingeniería, Consultoría y Construcción
LUIS ROBERTO ROSAS MARIN
C.C. 7'222.548. Ing. Civil Esp Geotecnia
Mat. Prof. 25202 – 70230 CND.
Representante Legal

Anexo: Copia tarjeta profesional





CERTIFICADO DE VIGENCIA Y ANTECEDENTES DISCIPLINARIOS
Nº E2016WEB00006978

REPÚBLICA DE COLOMBIA
CONSEJO PROFESIONAL NACIONAL DE
INGENIERÍA
COPNIA

EL DIRECTOR GENERAL

CERTIFICA:

1. Que ROSAS MARIN LUIS ROBERTO identificado (a) con Cédula de Ciudadanía Nº 7222548, se encuentra inscrito(a) en el Registro Profesional Nacional que lleva esta entidad, como INGENIERO CIVIL con Matrícula Profesional Nº 25202-70230 CND desde el (los) diecinueve (19) día(s) del mes de febrero del año mil novecientos noventa y ocho (1998).
2. Que la (el) Matrícula Profesional es la autorización que expide el Estado para que el titular ejerza su profesión en todo el territorio de la República de Colombia, de conformidad con lo dispuesto en la Ley 842 de 2003.
3. Que la (el) referida (o) Matrícula Profesional se encuentra vigente, por lo cual el profesional certificado actualmente NO está impedido para ejercer la profesión.
4. Que el profesional NO tiene antecedentes disciplinarios ético-profesionales.
5. Que la presente certificación tiene una validez de seis (6) meses y se expide en Bogotá, D.C., a los quince (15) días del mes (enero) del año dos mil dieciséis (2016).


ROBÉN DARÍO OCHOA ARBELÁEZ

Firma del titular (*)

(*) Con el fin de verificar que el titular autoriza su participación en procesos estatales de selección de contratistas. La falta de firma del titular no invalida el Certificado.
El presente es un documento público expedido electrónicamente con firma digital que garantiza su plena validez jurídica y probatoria según lo establecido en la Ley 527 de 1999.
Para verificar la integridad e inalterabilidad del presente documento consulte en el sitio web <http://gdocumental.copnia.gov.co/InvesiteCSV> indicado el código que se encuentra en el costado izquierdo de este documento.
Calle 78 Nº 9 - 57 Piso 13 - Bogotá D.C. Pbx: 3220102 - Correo-e: info@copnia.gov.co
www.copnia.gov.co

CONSEJO PROFESIONAL NACIONAL DE INGENIERÍA - COPNIA
Calle 78 Nº 9 - 57 - Teléfono: 3220102 - Bogotá D.C.
email: info@copnia.gov.co - pqr@copnia.gov.co
www.copnia.gov.co



Documento emitido por: CONSEJO PROFESIONAL NACIONAL DE INGENIERÍA - COPNIA, Nº de serie: E2016WEB00006978, Fecha de emisión: 15/01/2016 09:46:03.
Código Seguro de Verificación (CSV): <http://gdocumental.copnia.gov.co/InvesiteCSV> s3aRtHqzPOzml9TXU3W <http://www.copnia.gov.co>
Página 1 de un total de 1 página(s).

ANEXO
REGISTRO FOTOGRÁFICO

ESTACIÓN SAN GIL







