

0	24/05/2016	A. 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><div><div>RTVC</div><div>Sistema de Medios Públicos</div></div><div></div></div> <div>TORRE 90 m + EXTENSION 15 m EL RUIZ – MANIZALES - CALDAS</div>						
<div>EVALUACION ESTRUCTURAL</div> <div><div></div><div><div>BTESA</div><div>BROAD TELECOM</div></div></div>						
ESCALA SIN	FORMATO A4	REFERENCIA BTESA TAC90-E 15-ER-MC		REFERENCIA RTVC TORRE 90-EL RUIZ-CALDAS		HOJA 1/26
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EVALUACION ESTRUCTURAL TAC90



TORRE 90m+EXT.15m

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TORRE 90 m + EXTENSION 15 m

EVALUACION ESTRUCTURAL

1. DESCRIPCIÓN:

A continuación presentamos la verificación estructural de la torre auto-soportada de 90 metros, instalada en la estación El Ruiz - Manizales (Caldas), es tipo celosía de sección cuadrada, diseñada con perfiles angulares; El chequeo se hace con las cargas de antenas instaladas actualmente: Veinticuatro (24) antenas TV Thomson, Veintidos (22) antenas TV dipolo, una (1) antena MWØ2.8m, tres (3) antena MWØ3.6m, una (1) antena MWØ4.6m, una (1) antena MWØ4.8m y una (1) antenas Yagui; Se proyecta la instalación de ocho (8) antenas panel TV, en una extensión de 15m, según cuadro y luego se verifican los elementos que requieren refuerzo.

2. ESPECIFICACIONES:

Carga de diseño:

TIPO / DIAMETRO	ALTURA EN TORRE	CANTIDAD
ANTENAS EXISTENTES		
ANTENA TV Th	88,5 m	24 und
ANTENA TV Dp	80,0 m	4 und
ANTENA TV Dp	76,0 m	2 und
ANTENA TV Dp	69,0 m	4 und
ANTENA TV Dp	65,5 m	2 und
ANTENA TV Dp	52,5 m	6 und
ANTENA TV Dp	44,0 m	4 und
ANTENA YAGUI	33,0 m	1 und
ANT_MWØ3.6	13,0 m	1 und
ANT_MWØ2.8	13,0 m	1 und
ANT_MWØ4.6	8,0 m	1 und
ANT_MWØ4.8	8,0 m	1 und
ANT_MWØ3.6	4,5 m	1 und
ANT_MWØ3.6	2,0 m	1 und
ANTENAS NUEVAS		
ANTENA PANEL	103,0 m	8 und

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

Velocidad del viento: 120. Km / h

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

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- Tornillos : ASTM A325 –G5

Galvanizado: Según norma ASTM A153 y ASTM A123

NOTA:

A CONTINUACION SE MUESTRAN LOS AZIMUT DE LAS CARAS DE LA TORRE:

AZIMUT DE LA CARA A: 40°

AZIMUT DE LA CARA B: 130°

AZIMUT DE LA CARA C: 220°

AZIMUT DE LA CARA D: 310°

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.

Para $P(0) = 76.2 \text{ kg / m}^2$

$P(10) = 76.2$

$P(90) = 115.3$

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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 90m+EXT.15m – EL RUIZ – MANIZALES – CALDAS

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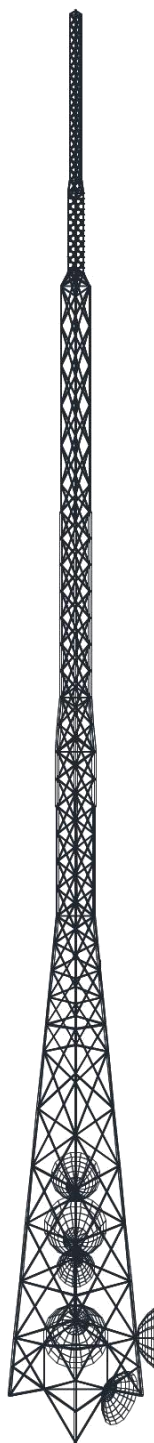
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SILUETA TAC90-ANTENAS



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LISTADO TOWER

 *
 * TOWER - Analysis and Design - Copyright Power Line Systems, Inc. 1986-2006 *
 *

Project Name : TORRE 90.m+EXT.15m - EL RUIZ -ACT.
 Project Notes: BTESA - RTVC
 Project File : f:\arch 2016\eval btesa\tac90e15el ruiz\tor90e15ruiz.tow
 Date run : 02:22:27 p.m. lunes, 23 de mayo de 2016
 by : Tower Version 10.20

Successfully performed linear analysis

The model has 0 warnings.



Member check option: TIA/EIA 222-F
 Connection rupture check: Not Checked
 Crossing diagonal check: Fixed

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.
1P	XY-Symmetry	0.3	0.3	105	Free	Free	Free	Free	Free	Free
17P	XY-Symmetry	0.3	0.3	92.5	Free	Free	Free	Free	Free	Free
18P	XY-Symmetry	0.41	0.41	91.5	Free	Free	Free	Free	Free	Free
33P	XY-Symmetry	0.41	0.41	85.5	Free	Free	Free	Free	Free	Free
34P	XY-Symmetry	0.76	0.76	84.5	Free	Free	Free	Free	Free	Free
39P	XY-Symmetry	0.76	0.76	69.5	Free	Free	Free	Free	Free	Free
47P	XY-Symmetry	0.76	0.76	53.5	Free	Free	Free	Free	Free	Free
49P	XY-Symmetry	0.975	0.975	49.4	Free	Free	Free	Free	Free	Free
55P	XY-Symmetry	0.975	0.975	37	Free	Free	Free	Free	Free	Free
60P	XY-Symmetry	1.694	1.694	26.8	Free	Free	Free	Free	Free	Free
66P	XY-Symmetry	3.513	3.513	0.84	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
1X	X-GenXY	0.3	-0.3	105	Free	Free	Free	Free	Free	Free
1XY	XY-GenXY	-0.3	-0.3	105	Free	Free	Free	Free	Free	Free
1Y	Y-GenXY	-0.3	0.3	105	Free	Free	Free	Free	Free	Free
17X	X-GenXY	0.3	-0.3	92.5	Free	Free	Free	Free	Free	Free
17XY	XY-GenXY	-0.3	-0.3	92.5	Free	Free	Free	Free	Free	Free
17Y	Y-GenXY	-0.3	0.3	92.5	Free	Free	Free	Free	Free	Free
18X	X-GenXY	0.41	-0.41	91.5	Free	Free	Free	Free	Free	Free
18XY	XY-GenXY	-0.41	-0.41	91.5	Free	Free	Free	Free	Free	Free
18Y	Y-GenXY	-0.41	0.41	91.5	Free	Free	Free	Free	Free	Free
33X	X-GenXY	0.41	-0.41	85.5	Free	Free	Free	Free	Free	Free
33XY	XY-GenXY	-0.41	-0.41	85.5	Free	Free	Free	Free	Free	Free
33Y	Y-GenXY	-0.41	0.41	85.5	Free	Free	Free	Free	Free	Free
34X	X-GenXY	0.76	-0.76	84.5	Free	Free	Free	Free	Free	Free
34XY	XY-GenXY	-0.76	-0.76	84.5	Free	Free	Free	Free	Free	Free
34Y	Y-GenXY	-0.76	0.76	84.5	Free	Free	Free	Free	Free	Free
39X	X-GenXY	0.76	-0.76	69.5	Free	Free	Free	Free	Free	Free
39XY	XY-GenXY	-0.76	-0.76	69.5	Free	Free	Free	Free	Free	Free
39Y	Y-GenXY	-0.76	0.76	69.5	Free	Free	Free	Free	Free	Free
47X	X-GenXY	0.76	-0.76	53.5	Free	Free	Free	Free	Free	Free

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47XY	XY-GenXY	-0.76	-0.76	53.5	Free	Free	Free	Free	Free	Free	Free
47Y	Y-GenXY	-0.76	0.76	53.5	Free	Free	Free	Free	Free	Free	Free
49X	X-GenXY	0.975	-0.975	49.4	Free	Free	Free	Free	Free	Free	Free
49XY	XY-GenXY	-0.975	-0.975	49.4	Free	Free	Free	Free	Free	Free	Free
49Y	Y-GenXY	-0.975	0.975	49.4	Free	Free	Free	Free	Free	Free	Free
55X	X-GenXY	0.975	-0.975	37	Free	Free	Free	Free	Free	Free	Free
55XY	XY-GenXY	-0.975	-0.975	37	Free	Free	Free	Free	Free	Free	Free
55Y	Y-GenXY	-0.975	0.975	37	Free	Free	Free	Free	Free	Free	Free
60X	X-GenXY	1.694	-1.694	26.8	Free	Free	Free	Free	Free	Free	Free
60XY	XY-GenXY	-1.694	-1.694	26.8	Free	Free	Free	Free	Free	Free	Free
60Y	Y-GenXY	-1.694	1.694	26.8	Free	Free	Free	Free	Free	Free	Free
66X	X-GenXY	3.513	-3.513	0.84	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
66XY	XY-GenXY	-3.513	-3.513	0.84	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
66Y	Y-GenXY	-3.513	3.513	0.84	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed

Secondary Joints:

Joint Label	Symmetry Code	Origin Joint	End Joint	Fraction	Elevation	X Disp. Rest.	Y Disp. Rest.	Z Disp. Rest.	X Rot. Rest.	Y Rot. Rest.	Z Rot. Rest.
(m)											
2S	XY-Symmetry	1P	17P	0.063	0	Free	Free	Free	Free	Free	Free
3S	XY-Symmetry	1P	17P	0.125	0	Free	Free	Free	Free	Free	Free
4S	XY-Symmetry	1P	17P	0.188	0	Free	Free	Free	Free	Free	Free
5S	XY-Symmetry	1P	17P	0.25	0	Free	Free	Free	Free	Free	Free
6S	XY-Symmetry	1P	17P	0.313	0	Free	Free	Free	Free	Free	Free
7S	XY-Symmetry	1P	17P	0.375	0	Free	Free	Free	Free	Free	Free
8S	XY-Symmetry	1P	17P	0.438	0	Free	Free	Free	Free	Free	Free
9S	XY-Symmetry	1P	17P	0.5	0	Free	Free	Free	Free	Free	Free
10S	XY-Symmetry	1P	17P	0.563	0	Free	Free	Free	Free	Free	Free
11S	XY-Symmetry	1P	17P	0.625	0	Free	Free	Free	Free	Free	Free
12S	XY-Symmetry	1P	17P	0.688	0	Free	Free	Free	Free	Free	Free
13S	XY-Symmetry	1P	17P	0.75	0	Free	Free	Free	Free	Free	Free
14S	XY-Symmetry	1P	17P	0.813	0	Free	Free	Free	Free	Free	Free
15S	XY-Symmetry	1P	17P	0.875	0	Free	Free	Free	Free	Free	Free
16S	XY-Symmetry	1P	17P	0.938	0	Free	Free	Free	Free	Free	Free
19S	XY-Symmetry	18P	33P	0.067	0	Free	Free	Free	Free	Free	Free
20S	XY-Symmetry	18P	33P	0.133	0	Free	Free	Free	Free	Free	Free
21S	XY-Symmetry	18P	33P	0.2	0	Free	Free	Free	Free	Free	Free
22S	XY-Symmetry	18P	33P	0.267	0	Free	Free	Free	Free	Free	Free
23S	XY-Symmetry	18P	33P	0.333	0	Free	Free	Free	Free	Free	Free
24S	XY-Symmetry	18P	33P	0.4	0	Free	Free	Free	Free	Free	Free
25S	XY-Symmetry	18P	33P	0.467	0	Free	Free	Free	Free	Free	Free
26S	XY-Symmetry	18P	33P	0.533	0	Free	Free	Free	Free	Free	Free
27S	XY-Symmetry	18P	33P	0.6	0	Free	Free	Free	Free	Free	Free
28S	XY-Symmetry	18P	33P	0.667	0	Free	Free	Free	Free	Free	Free
29S	XY-Symmetry	18P	33P	0.733	0	Free	Free	Free	Free	Free	Free
30S	XY-Symmetry	18P	33P	0.8	0	Free	Free	Free	Free	Free	Free
31S	XY-Symmetry	18P	33P	0.867	0	Free	Free	Free	Free	Free	Free
32S	XY-Symmetry	18P	33P	0.933	0	Free	Free	Free	Free	Free	Free
35S	XY-Symmetry	34P	39P	0.2	0	Free	Free	Free	Free	Free	Free
36S	XY-Symmetry	34P	39P	0.4	0	Free	Free	Free	Free	Free	Free
37S	XY-Symmetry	34P	39P	0.6	0	Free	Free	Free	Free	Free	Free
38S	XY-Symmetry	34P	39P	0.8	0	Free	Free	Free	Free	Free	Free
40S	XY-Symmetry	39P	47P	0.125	0	Free	Free	Free	Free	Free	Free
41S	XY-Symmetry	39P	47P	0.25	0	Free	Free	Free	Free	Free	Free
42S	XY-Symmetry	39P	47P	0.375	0	Free	Free	Free	Free	Free	Free
43S	XY-Symmetry	39P	47P	0.5	0	Free	Free	Free	Free	Free	Free
44S	XY-Symmetry	39P	47P	0.625	0	Free	Free	Free	Free	Free	Free
45S	XY-Symmetry	39P	47P	0.75	0	Free	Free	Free	Free	Free	Free
46S	XY-Symmetry	39P	47P	0.875	0	Free	Free	Free	Free	Free	Free
48S	XY-Symmetry	47P	49P	0.5	0	Free	Free	Free	Free	Free	Free
50S	XY-Symmetry	49P	55P	0.166	0	Free	Free	Free	Free	Free	Free
51S	XY-Symmetry	49P	55P	0.333	0	Free	Free	Free	Free	Free	Free
52S	XY-Symmetry	49P	55P	0.5	0	Free	Free	Free	Free	Free	Free
53S	XY-Symmetry	49P	55P	0.667	0	Free	Free	Free	Free	Free	Free
54S	XY-Symmetry	49P	55P	0.833	0	Free	Free	Free	Free	Free	Free
56S	XY-Symmetry	55P	60P	0.2	0	Free	Free	Free	Free	Free	Free
57S	XY-Symmetry	55P	60P	0.4	0	Free	Free	Free	Free	Free	Free
58S	XY-Symmetry	55P	60P	0.6	0	Free	Free	Free	Free	Free	Free
59S	XY-Symmetry	55P	60P	0.8	0	Free	Free	Free	Free	Free	Free
61S	XY-Symmetry	60P	66P	0.166	0	Free	Free	Free	Free	Free	Free
62S	XY-Symmetry	60P	66P	0.333	0	Free	Free	Free	Free	Free	Free
63S	XY-Symmetry	60P	66P	0.5	0	Free	Free	Free	Free	Free	Free
64S	XY-Symmetry	60P	66P	0.667	0	Free	Free	Free	Free	Free	Free
65S	XY-Symmetry	60P	66P	0.833	0	Free	Free	Free	Free	Free	Free
67S	XY-Symmetry	65S	66P	0.5	0	Free	Free	Free	Free	Free	Free
68S	Y-Symmetry	67S	67X	0.5	0	Free	Free	Free	Free	Free	Free
69S	X-Symmetry	67S	67Y	0.5	0	Free	Free	Free	Free	Free	Free
2X	X-GenXY	1P	17P	0.063	0	Free	Free	Free	Free	Free	Free
2XY	XY-GenXY	1P	17P	0.063	0	Free	Free	Free	Free	Free	Free
2Y	Y-GenXY	1P	17P	0.063	0	Free	Free	Free	Free	Free	Free
3X	X-GenXY	1P	17P	0.125	0	Free	Free	Free	Free	Free	Free
3XY	XY-GenXY	1P	17P	0.125	0	Free	Free	Free	Free	Free	Free

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3Y	Y-GenXY	1P	17P	0.125	0	Free	Free	Free	Free	Free	Free
4X	X-GenXY	1P	17P	0.188	0	Free	Free	Free	Free	Free	Free
4XY	XY-GenXY	1P	17P	0.188	0	Free	Free	Free	Free	Free	Free
4Y	Y-GenXY	1P	17P	0.188	0	Free	Free	Free	Free	Free	Free
5X	X-GenXY	1P	17P	0.25	0	Free	Free	Free	Free	Free	Free
5XY	XY-GenXY	1P	17P	0.25	0	Free	Free	Free	Free	Free	Free
5Y	Y-GenXY	1P	17P	0.25	0	Free	Free	Free	Free	Free	Free
6X	X-GenXY	1P	17P	0.313	0	Free	Free	Free	Free	Free	Free
6XY	XY-GenXY	1P	17P	0.313	0	Free	Free	Free	Free	Free	Free
6Y	Y-GenXY	1P	17P	0.313	0	Free	Free	Free	Free	Free	Free
7X	X-GenXY	1P	17P	0.375	0	Free	Free	Free	Free	Free	Free
7XY	XY-GenXY	1P	17P	0.375	0	Free	Free	Free	Free	Free	Free
7Y	Y-GenXY	1P	17P	0.375	0	Free	Free	Free	Free	Free	Free
8X	X-GenXY	1P	17P	0.438	0	Free	Free	Free	Free	Free	Free
8XY	XY-GenXY	1P	17P	0.438	0	Free	Free	Free	Free	Free	Free
8Y	Y-GenXY	1P	17P	0.438	0	Free	Free	Free	Free	Free	Free
9X	X-GenXY	1P	17P	0.5	0	Free	Free	Free	Free	Free	Free
9XY	XY-GenXY	1P	17P	0.5	0	Free	Free	Free	Free	Free	Free
9Y	Y-GenXY	1P	17P	0.5	0	Free	Free	Free	Free	Free	Free
10X	X-GenXY	1P	17P	0.563	0	Free	Free	Free	Free	Free	Free
10XY	XY-GenXY	1P	17P	0.563	0	Free	Free	Free	Free	Free	Free
10Y	Y-GenXY	1P	17P	0.563	0	Free	Free	Free	Free	Free	Free
11X	X-GenXY	1P	17P	0.625	0	Free	Free	Free	Free	Free	Free
11XY	XY-GenXY	1P	17P	0.625	0	Free	Free	Free	Free	Free	Free
11Y	Y-GenXY	1P	17P	0.625	0	Free	Free	Free	Free	Free	Free
12X	X-GenXY	1P	17P	0.688	0	Free	Free	Free	Free	Free	Free
12XY	XY-GenXY	1P	17P	0.688	0	Free	Free	Free	Free	Free	Free
12Y	Y-GenXY	1P	17P	0.688	0	Free	Free	Free	Free	Free	Free
13X	X-GenXY	1P	17P	0.75	0	Free	Free	Free	Free	Free	Free
13XY	XY-GenXY	1P	17P	0.75	0	Free	Free	Free	Free	Free	Free
13Y	Y-GenXY	1P	17P	0.75	0	Free	Free	Free	Free	Free	Free
14X	X-GenXY	1P	17P	0.813	0	Free	Free	Free	Free	Free	Free
14XY	XY-GenXY	1P	17P	0.813	0	Free	Free	Free	Free	Free	Free
14Y	Y-GenXY	1P	17P	0.813	0	Free	Free	Free	Free	Free	Free
15X	X-GenXY	1P	17P	0.875	0	Free	Free	Free	Free	Free	Free
15XY	XY-GenXY	1P	17P	0.875	0	Free	Free	Free	Free	Free	Free
15Y	Y-GenXY	1P	17P	0.875	0	Free	Free	Free	Free	Free	Free
16X	X-GenXY	1P	17P	0.938	0	Free	Free	Free	Free	Free	Free
16XY	XY-GenXY	1P	17P	0.938	0	Free	Free	Free	Free	Free	Free
16Y	Y-GenXY	1P	17P	0.938	0	Free	Free	Free	Free	Free	Free
19X	X-GenXY	18P	33P	0.067	0	Free	Free	Free	Free	Free	Free
19XY	XY-GenXY	18P	33P	0.067	0	Free	Free	Free	Free	Free	Free
19Y	Y-GenXY	18P	33P	0.067	0	Free	Free	Free	Free	Free	Free
20X	X-GenXY	18P	33P	0.133	0	Free	Free	Free	Free	Free	Free
20XY	XY-GenXY	18P	33P	0.133	0	Free	Free	Free	Free	Free	Free
20Y	Y-GenXY	18P	33P	0.133	0	Free	Free	Free	Free	Free	Free
21X	X-GenXY	18P	33P	0.2	0	Free	Free	Free	Free	Free	Free
21XY	XY-GenXY	18P	33P	0.2	0	Free	Free	Free	Free	Free	Free
21Y	Y-GenXY	18P	33P	0.2	0	Free	Free	Free	Free	Free	Free
22X	X-GenXY	18P	33P	0.267	0	Free	Free	Free	Free	Free	Free
22XY	XY-GenXY	18P	33P	0.267	0	Free	Free	Free	Free	Free	Free
22Y	Y-GenXY	18P	33P	0.267	0	Free	Free	Free	Free	Free	Free
23X	X-GenXY	18P	33P	0.333	0	Free	Free	Free	Free	Free	Free
23XY	XY-GenXY	18P	33P	0.333	0	Free	Free	Free	Free	Free	Free
23Y	Y-GenXY	18P	33P	0.333	0	Free	Free	Free	Free	Free	Free
24X	X-GenXY	18P	33P	0.4	0	Free	Free	Free	Free	Free	Free
24XY	XY-GenXY	18P	33P	0.4	0	Free	Free	Free	Free	Free	Free
24Y	Y-GenXY	18P	33P	0.4	0	Free	Free	Free	Free	Free	Free
25X	X-GenXY	18P	33P	0.467	0	Free	Free	Free	Free	Free	Free
25XY	XY-GenXY	18P	33P	0.467	0	Free	Free	Free	Free	Free	Free
25Y	Y-GenXY	18P	33P	0.467	0	Free	Free	Free	Free	Free	Free
26X	X-GenXY	18P	33P	0.533	0	Free	Free	Free	Free	Free	Free
26XY	XY-GenXY	18P	33P	0.533	0	Free	Free	Free	Free	Free	Free
26Y	Y-GenXY	18P	33P	0.533	0	Free	Free	Free	Free	Free	Free
27X	X-GenXY	18P	33P	0.6	0	Free	Free	Free	Free	Free	Free
27XY	XY-GenXY	18P	33P	0.6	0	Free	Free	Free	Free	Free	Free
27Y	Y-GenXY	18P	33P	0.6	0	Free	Free	Free	Free	Free	Free
28X	X-GenXY	18P	33P	0.667	0	Free	Free	Free	Free	Free	Free
28XY	XY-GenXY	18P	33P	0.667	0	Free	Free	Free	Free	Free	Free
28Y	Y-GenXY	18P	33P	0.667	0	Free	Free	Free	Free	Free	Free
29X	X-GenXY	18P	33P	0.733	0	Free	Free	Free	Free	Free	Free
29XY	XY-GenXY	18P	33P	0.733	0	Free	Free	Free	Free	Free	Free
29Y	Y-GenXY	18P	33P	0.733	0	Free	Free	Free	Free	Free	Free
30X	X-GenXY	18P	33P	0.8	0	Free	Free	Free	Free	Free	Free
30XY	XY-GenXY	18P	33P	0.8	0	Free	Free	Free	Free	Free	Free
30Y	Y-GenXY	18P	33P	0.8	0	Free	Free	Free	Free	Free	Free
31X	X-GenXY	18P	33P	0.867	0	Free	Free	Free	Free	Free	Free
31XY	XY-GenXY	18P	33P	0.867	0	Free	Free	Free	Free	Free	Free
31Y	Y-GenXY	18P	33P	0.867	0	Free	Free	Free	Free	Free	Free
32X	X-GenXY	18P	33P	0.933	0	Free	Free	Free	Free	Free	Free
32XY	XY-GenXY	18P	33P	0.933	0	Free	Free	Free	Free	Free	Free
32Y	Y-GenXY	18P	33P	0.933	0	Free	Free	Free	Free	Free	Free
35X	X-GenXY	34P	39P	0.2	0	Free	Free	Free	Free	Free	Free
35XY	XY-GenXY	34P	39P	0.2	0	Free	Free	Free	Free	Free	Free

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35Y	Y-GenXY	34P	39P	0.2	0	Free	Free	Free	Free	Free	Free
36X	X-GenXY	34P	39P	0.4	0	Free	Free	Free	Free	Free	Free
36XY	XY-GenXY	34P	39P	0.4	0	Free	Free	Free	Free	Free	Free
36Y	Y-GenXY	34P	39P	0.4	0	Free	Free	Free	Free	Free	Free
37X	X-GenXY	34P	39P	0.6	0	Free	Free	Free	Free	Free	Free
37XY	XY-GenXY	34P	39P	0.6	0	Free	Free	Free	Free	Free	Free
37Y	Y-GenXY	34P	39P	0.6	0	Free	Free	Free	Free	Free	Free
38X	X-GenXY	34P	39P	0.8	0	Free	Free	Free	Free	Free	Free
38XY	XY-GenXY	34P	39P	0.8	0	Free	Free	Free	Free	Free	Free
38Y	Y-GenXY	34P	39P	0.8	0	Free	Free	Free	Free	Free	Free
40X	X-GenXY	39P	47P	0.125	0	Free	Free	Free	Free	Free	Free
40XY	XY-GenXY	39P	47P	0.125	0	Free	Free	Free	Free	Free	Free
40Y	Y-GenXY	39P	47P	0.125	0	Free	Free	Free	Free	Free	Free
41X	X-GenXY	39P	47P	0.25	0	Free	Free	Free	Free	Free	Free
41XY	XY-GenXY	39P	47P	0.25	0	Free	Free	Free	Free	Free	Free
41Y	Y-GenXY	39P	47P	0.25	0	Free	Free	Free	Free	Free	Free
42X	X-GenXY	39P	47P	0.375	0	Free	Free	Free	Free	Free	Free
42XY	XY-GenXY	39P	47P	0.375	0	Free	Free	Free	Free	Free	Free
42Y	Y-GenXY	39P	47P	0.375	0	Free	Free	Free	Free	Free	Free
43X	X-GenXY	39P	47P	0.5	0	Free	Free	Free	Free	Free	Free
43XY	XY-GenXY	39P	47P	0.5	0	Free	Free	Free	Free	Free	Free
43Y	Y-GenXY	39P	47P	0.5	0	Free	Free	Free	Free	Free	Free
44X	X-GenXY	39P	47P	0.625	0	Free	Free	Free	Free	Free	Free
44XY	XY-GenXY	39P	47P	0.625	0	Free	Free	Free	Free	Free	Free
44Y	Y-GenXY	39P	47P	0.625	0	Free	Free	Free	Free	Free	Free
45X	X-GenXY	39P	47P	0.75	0	Free	Free	Free	Free	Free	Free
45XY	XY-GenXY	39P	47P	0.75	0	Free	Free	Free	Free	Free	Free
45Y	Y-GenXY	39P	47P	0.75	0	Free	Free	Free	Free	Free	Free
46X	X-GenXY	39P	47P	0.875	0	Free	Free	Free	Free	Free	Free
46XY	XY-GenXY	39P	47P	0.875	0	Free	Free	Free	Free	Free	Free
46Y	Y-GenXY	39P	47P	0.875	0	Free	Free	Free	Free	Free	Free
48X	X-GenXY	47P	49P	0.5	0	Free	Free	Free	Free	Free	Free
48XY	XY-GenXY	47P	49P	0.5	0	Free	Free	Free	Free	Free	Free
48Y	Y-GenXY	47P	49P	0.5	0	Free	Free	Free	Free	Free	Free
50X	X-GenXY	49P	55P	0.166	0	Free	Free	Free	Free	Free	Free
50XY	XY-GenXY	49P	55P	0.166	0	Free	Free	Free	Free	Free	Free
50Y	Y-GenXY	49P	55P	0.166	0	Free	Free	Free	Free	Free	Free
51X	X-GenXY	49P	55P	0.333	0	Free	Free	Free	Free	Free	Free
51XY	XY-GenXY	49P	55P	0.333	0	Free	Free	Free	Free	Free	Free
51Y	Y-GenXY	49P	55P	0.333	0	Free	Free	Free	Free	Free	Free
52X	X-GenXY	49P	55P	0.5	0	Free	Free	Free	Free	Free	Free
52XY	XY-GenXY	49P	55P	0.5	0	Free	Free	Free	Free	Free	Free
52Y	Y-GenXY	49P	55P	0.5	0	Free	Free	Free	Free	Free	Free
53X	X-GenXY	49P	55P	0.667	0	Free	Free	Free	Free	Free	Free
53XY	XY-GenXY	49P	55P	0.667	0	Free	Free	Free	Free	Free	Free
53Y	Y-GenXY	49P	55P	0.667	0	Free	Free	Free	Free	Free	Free
54X	X-GenXY	49P	55P	0.833	0	Free	Free	Free	Free	Free	Free
54XY	XY-GenXY	49P	55P	0.833	0	Free	Free	Free	Free	Free	Free
54Y	Y-GenXY	49P	55P	0.833	0	Free	Free	Free	Free	Free	Free
56X	X-GenXY	55P	60P	0.2	0	Free	Free	Free	Free	Free	Free
56XY	XY-GenXY	55P	60P	0.2	0	Free	Free	Free	Free	Free	Free
56Y	Y-GenXY	55P	60P	0.2	0	Free	Free	Free	Free	Free	Free
57X	X-GenXY	55P	60P	0.4	0	Free	Free	Free	Free	Free	Free
57XY	XY-GenXY	55P	60P	0.4	0	Free	Free	Free	Free	Free	Free
57Y	Y-GenXY	55P	60P	0.4	0	Free	Free	Free	Free	Free	Free
58X	X-GenXY	55P	60P	0.6	0	Free	Free	Free	Free	Free	Free
58XY	XY-GenXY	55P	60P	0.6	0	Free	Free	Free	Free	Free	Free
58Y	Y-GenXY	55P	60P	0.6	0	Free	Free	Free	Free	Free	Free
59X	X-GenXY	55P	60P	0.8	0	Free	Free	Free	Free	Free	Free
59XY	XY-GenXY	55P	60P	0.8	0	Free	Free	Free	Free	Free	Free
59Y	Y-GenXY	55P	60P	0.8	0	Free	Free	Free	Free	Free	Free
61X	X-GenXY	60P	66P	0.166	0	Free	Free	Free	Free	Free	Free
61XY	XY-GenXY	60P	66P	0.166	0	Free	Free	Free	Free	Free	Free
61Y	Y-GenXY	60P	66P	0.166	0	Free	Free	Free	Free	Free	Free
62X	X-GenXY	60P	66P	0.333	0	Free	Free	Free	Free	Free	Free
62XY	XY-GenXY	60P	66P	0.333	0	Free	Free	Free	Free	Free	Free
62Y	Y-GenXY	60P	66P	0.333	0	Free	Free	Free	Free	Free	Free
63X	X-GenXY	60P	66P	0.5	0	Free	Free	Free	Free	Free	Free
63XY	XY-GenXY	60P	66P	0.5	0	Free	Free	Free	Free	Free	Free
63Y	Y-GenXY	60P	66P	0.5	0	Free	Free	Free	Free	Free	Free
64X	X-GenXY	60P	66P	0.667	0	Free	Free	Free	Free	Free	Free
64XY	XY-GenXY	60P	66P	0.667	0	Free	Free	Free	Free	Free	Free
64Y	Y-GenXY	60P	66P	0.667	0	Free	Free	Free	Free	Free	Free
65X	X-GenXY	60P	66P	0.833	0	Free	Free	Free	Free	Free	Free
65XY	XY-GenXY	60P	66P	0.833	0	Free	Free	Free	Free	Free	Free
65Y	Y-GenXY	60P	66P	0.833	0	Free	Free	Free	Free	Free	Free
67X	X-GenXY	65S	66P	0.5	0	Free	Free	Free	Free	Free	Free
67XY	XY-GenXY	65S	66P	0.5	0	Free	Free	Free	Free	Free	Free
67Y	Y-GenXY	65S	66P	0.5	0	Free	Free	Free	Free	Free	Free
68Y	Y-Gen	67S	67X	0.5	0	Free	Free	Free	Free	Free	Free
69X	X-Gen	67S	67Y	0.5	0	Free	Free	Free	Free	Free	Free

Steel Material Properties:

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Steel Material Label	Modulus of Elasticity (MPa)	Yield Stress Fy (MPa)	Ultimate Stress Fu (MPa)	Member All. Stress Hyp. 1 (MPa)	Member All. Stress Hyp. 2 (MPa)	Member Rupture Hyp. 1 (MPa)	Member Rupture Hyp. 2 (MPa)	Member Bearing Hyp. 1 (MPa)	Member Bearing Hyp. 2 (MPa)
A-36	2e+005	248.1	399.9	0	0	0	0	0	0
A-572	2e+005	344.7	482.5	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)
1/2"	1.27	1.428	40.11	2	0	0	0
5/8"	1.59	1.749	62.53	2.5	0	0	0
5/8" DC	1.59	1.749	125	2.5	0	0	0
3/4"	1.905	2.064	75.17	3	0	0	0
3/4" DC	1.905	2.064	150.3	3	0	0	0

Number Bolts Used By Type:

Bolt Type	Number Bolts
3/4" DC	1216
5/8" DC	768
3/4"	432
1/2"	112
5/8"	248

Angle Properties:

Angle Type	Angle Size	Long Leg (cm)	Short Leg (cm)	Thick. (cm)	Unit Weight (N/m)	Gross Area (cm²)	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 (cm³)
SAE	2.5X2.5X0.1875	6.35	6.35	0.4763	44.8	5.935	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	7	1.567	1.567	1.001	1	5.08	0	0	1.0000	0
DAI	L6X5/16+6X5/16	15.24	15.24	0.794	367.1	46.77	10	6.381	6.381	5.781	1	30.41	0	0	1.0000	0
DAI	L5X5/16+5X5/16	12.7	12.7	0.7935	306.2	39.01	11	5.341	5.341	4.821	2	25.41	0	0	1.0000	0
DAI	2L5X5/16+5X5/16	12.7	12.7	0.7935	459.2	58.52	11	5.341	5.341	4.821	2	25.41	0	0	1.0000	0
DAI	L4X5/16+4X5/16	20.32	20.32	0.7935	243.2	30.98	8.67	4.267	4.267	3.861	2	10.16	0	0	1.0000	0
DAI	L3X5/16+3X5/16	15.24	15.24	0.7935	180.2	22.96	10.25	3.2	3.2	2.896	1	15.24	0	0	1.0000	0
DAI	L2.5X3/16+2.5X3/16	6.41	6.41	0.1875	91.37	11.64	8.87	2.672	2.672	2.413	1	12.71	0	0	1.0000	0
DAI	L2.5X3/16+2X1/8	6.41	6.41	0.1875	91.37	11.64	8.87	2.402	2.402	2.172	1	11.43	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 For Optimize (cm)
1	M01	DAI	L6X5/16+6X5/16	A-572	Beam		Size + Type	30.480
2	M02	DAI	L5X5/16+5X5/16	A-572	Beam		Size + Type	30.480
3	M03	DAI	2L5X5/16+5X5/16	A-572	Beam		Size + Type	30.480
4	M04	DAI	2L5X5/16+5X5/16	A-572	Beam		Size + Type	30.480
5	M05	DAI	L5X5/16+5X5/16	A-572	Beam		Size + Type	30.480
6	M06	DAI	L4X5/16+4X5/16	A-572	Beam		Size + Type	30.480
7	M07	DAI	L4X5/16+4X5/16	A-572	Beam		Size + Type	30.480
8	M08	DAI	L3X5/16+3X5/16	A-572	Beam		Size + Type	30.480
9	M09	DAI	L2.5X3/16+2.5X3/16	A-572	Beam		Size + Type	30.480
10	M10	DAI	L2.5X3/16+2.5X3/16	A-572	Beam		Size + Type	30.480
11	M11	DAI	L2.5X3/16+2X1/8	A-572	Beam		Size + Type	30.480
12	M12	SAE	2.5X2.5X0.1875	A-572	Beam		Size + Type	30.480
13	D01	SAE	2.5X2.5X0.1875	A-36	Truss		Size + Type	30.480
14	D02	SAE	2.5X2.5X0.1875	A-36	Truss		Size + Type	30.480
15	D03	SAE	2X2X0.1875	A-36	Truss		Size + Type	30.480
16	D04	SAE	2X2X0.1875	A-36	Truss		Size + Type	30.480
17	D05	SAE	2X2X0.1875	A-36	Truss		Size + Type	30.480
18	D06	SAE	2X2X0.1875	A-36	Truss		Size + Type	30.480
19	D07	SAE	2X2X0.1875	A-36	Truss		Size + Type	30.480
20	D08	SAE	2X2X0.1875	A-36	Truss		Size + Type	30.480
21	D09	SAE	2X2X0.1875	A-36	Truss		Size + Type	30.480
22	D10	SAE	2X2X0.1875	A-36	Truss		Size + Type	30.480
23	D11	SAE	2X2X0.1875	A-36	Truss		Size + Type	30.480
24	D12	SAE	2X2X0.1875	A-36	Truss		Size + Type	30.480
25	H01	SAE	2.5X2.5X0.1875	A-36	Beam		Size + Type	30.480
26	H02	SAE	2.5X2.5X0.1875	A-36	Beam		Size + Type	30.480
27	H03	SAE	2X2X0.1875	A-36	Beam		Size + Type	30.480
28	H04	SAE	2X2X0.1875	A-36	Beam		Size + Type	30.480
29	H05	SAE	2X2X0.1875	A-36	Beam		Size + Type	30.480

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30	H06	SAE	2X2X0.1875	A-36	Beam	Size + Type	30.480
31	H07	SAE	2X2X0.1875	A-36	Beam	Size + Type	30.480
32	H08	SAE	2X2X0.1875	A-36	Beam	Size + Type	30.480
33	C01	SAE	2X2X0.1875	A-36	Truss	Size + Type	30.480
34	C02	SAE	2X2X0.1875	A-36	Truss	Size + Type	30.480
35	C03	SAE	2X2X0.1875	A-36	Truss	Size + Type	30.480
36	C04	SAE	2X2X0.1875	A-36	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)
DAI	L6X5/16+6X5/16	A-572	34.75	21.18	12756.71
DAI	L5X5/16+5X5/16	A-572	67.94	34.51	20798.56
DAI	2L5X5/16+5X5/16	A-572	75.75	38.48	34786.43
DAI	L4X5/16+4X5/16	A-572	48.96	39.80	11907.18
DAI	L3X5/16+3X5/16	A-572	40.00	24.38	7209.44
DAI	L2.5X3/16+2.5X3/16	A-572	72.46	18.58	6621.25
DAI	L2.5X3/16+2X1/8	A-572	22.39	5.74	2046.05
SAE	2.5X2.5X0.1875	A-572	55.66	14.14	2493.30
SAE	2.5X2.5X0.1875	A-36	232.52	59.06	10416.47
SAE	2X2X0.1875	A-36	987.93	200.75	35175.53

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 EIA Only	Ar Round Factor EIA Only	Transverse Drag x Area Factor For All	Longitudinal Drag x Area Factor For All	SAPS Angle Factor	SAPS Round Factor	Force Solid Face
EXT1	17P	1.200	0.000	0.000	0.000	0.000	1.000	1.000	0.000	0.000	0.000	0.000	None
EXT2	18P	1.200	0.000	0.000	0.000	0.000	1.000	1.000	0.000	0.000	0.000	0.000	None
SECC1	33P	1.200	0.000	0.000	0.000	0.000	1.000	1.000	0.000	0.000	0.000	0.000	None
SECC2	34P	1.200	0.000	0.000	0.000	0.000	1.000	1.000	0.000	0.000	0.000	0.000	None
SECC3	39P	1.200	0.000	0.000	0.000	0.000	1.000	1.000	0.000	0.000	0.000	0.000	None
SECC4	47P	1.200	0.000	0.000	0.000	0.000	1.000	1.000	0.000	0.000	0.000	0.000	None
SECC5	49P	1.200	0.000	0.000	0.000	0.000	1.000	1.000	0.000	0.000	0.000	0.000	None
SECC6	55P	1.200	0.000	0.000	0.000	0.000	1.000	1.000	0.000	0.000	0.000	0.000	None
SECC7	60P	1.200	0.000	0.000	0.000	0.000	1.000	1.000	0.000	0.000	0.000	0.000	None
SECC8	63S	1.200	0.000	0.000	0.000	0.000	1.000	1.000	0.000	0.000	0.000	0.000	None
SECC9	66P	1.200	0.000	0.000	0.000	0.000	1.000	1.000	0.000	0.000	0.000	0.000	None

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*** Loads Data

Loads from file: f:\arch_2016\eval_btessa\tac90e15el_ruiz\tor90e15ruiz.eia

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

Structure height above ground 105.00 (m)
Elevation of structure bottom for wind height adjustment: 0.00 (m)
Structure height for structure gust response factor: 104.16 (m)
Structure gust response factor, Gh: 1.0797
Guy installation temperature: 15.56 (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)	Ice Wind Dir. Thick. (cm)	Ice Density (N/m^3)	Ice Temperature (deg C)	Point Loads	Joint Displ.
WIN 0 -120	1.2500	0.8500	1.0000	1.0000	1.3300	33.333	0 0.0000	0.0000	20.0	19 loads	
WIN 45-120	1.2500	0.8500	1.0000	1.0000	1.3300	33.333	45 0.0000	0.0000	20.0	19 loads	
WIN 45-60	1.2500	0.8500	1.0000	1.0000	1.3300	16.666	45 0.0000	0.0000	20.0	19 loads	

Concentrated Loads for Load Case "WIN 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
4S	920	230	480	0	0	0	
9S	920	230	480	0	0	0	

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13S	920	230	480	0	0	0
18P	805	200	840	0	0	0
22S	805	200	840	0	0	0
26S	805	200	840	0	0	0
34P	865	215	530	0	0	0
35S	865	215	530	0	0	0
36S	865	215	530	0	0	0
38S	850	250	900	0	0	0
39P	850	250	900	0	0	0
40S	850	250	900	0	0	0
41S	850	250	900	0	0	0
42S	850	250	900	0	0	0
46S	850	250	900	0	0	0
47P	850	250	900	0	0	0
48S	850	250	900	0	0	0
50S	850	250	900	0	0	0
51S	850	250	900	0	0	0

Equipment Load Case Information for "WIN 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 Axial Load (N)	Antenna Side Load (N)	Antenna Moment (MM)	Long. Load (N)	Trans. Load (N)	Vert. Load (N)
ANT.YAG	Ant.Yagui	32.92	877.08	0.00	0.18	0.00							157.87	0.00	312.50
ANT.MW1	Ant.MW03.6	13.82	684.44	0.00	0.00	315.00	1.62895	-0.04880	0.06130	11347.72	-339.95	1537.32	8264.44	-7783.67	4625.00
ANT.MW2	Ant.MW02.8	13.82	684.44	0.00	0.00	135.00	-0.52150	0.45705	0.13905	-2197.67	1926.07	1640.73	2915.92	-192.05	3750.00
ANT.MW3	Ant.MW04.6	9.48	625.05	0.00	0.00	315.00	1.62895	-0.04880	0.06130	16921.10	-506.92	2929.13	12323.47	-11606.57	6875.00
ANT.MW4	Ant.MW04.8	9.48	625.05	0.00	0.00	135.00	-0.52150	0.45705	0.13905	-5898.32	5169.38	7548.96	7826.05	-515.45	7250.00
ANT.MW5	Ant.MW03.6	5.18	625.05	0.00	0.00	225.00	-0.52150	-0.45705	-0.13905	-3317.66	-2907.65	-3184.58	4401.96	289.93	4625.00
ANT.MW6	Ant.MW03.6	3.01	625.05	0.00	0.00	180.00	-1.05470	0.00000	0.00000	-6709.76	0.00	0.00	6709.76	-0.00	4625.00

EIA Section Load Case Information for "WIN 0 -120":

Section Label	Z of Top (m)	Z of Ave. (m)	Elev. Above Gnd. (m)	qzGh (Pa)	Ice Thick. (cm)	Face AF (m²)	Face AR (m²)	Face RR (m²)	Face AG (m²)	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)	Total Wind (N)	Total Weight (N)	
EXT1	105.00	92.50	98.75	1200.46	0.00	2.91	0.00	0.00	7.5	0.39	1.00	1.00	0.65	2.31	2.9	8075	0.00	2.00	0.00	1.20	0.00	0	8075	9087
EXT2	92.50	91.50	92.00	1176.42	0.00	0.23	0.16	0.12	0.7	0.56	1.00	1.00	0.73	1.95	0.4	810	0.00	2.00	0.00	1.20	0.00	0	810	969
SECC1	91.50	85.50	88.50	1163.45	0.00	2.07	1.98	1.81	4.9	0.82	1.00	1.00	0.91	1.85	3.9	8358	0.00	2.00	0.00	1.20	0.00	0	8358	8020
SECC2	85.50	84.50	85.00	1150.12	0.00	0.52	0.33	0.28	1.2	0.73	1.00	1.00	0.84	1.82	0.8	1675	0.00	2.00	0.00	1.20	0.00	0	1675	2110
SECC3	84.50	69.50	77.00	1118.09	0.00	5.52	4.94	3.35	22.8	0.46	1.00	1.00	0.68	2.13	8.9	21172	0.00	2.00	0.00	1.20	0.00	0	21172	19458
SECC4	69.50	53.50	61.50	1048.54	0.00	6.49	5.27	3.64	24.3	0.48	1.00	1.00	0.69	2.08	10.1	22102	0.00	2.00	0.00	1.20	0.00	0	22102	31208
SECC5	53.50	49.40	51.45	996.43	0.00	1.48	1.35	0.88	7.1	0.40	1.00	1.00	0.65	2.29	2.4	5374	0.00	2.00	0.00	1.20	0.00	0	5374	10115
SECC6	49.40	37.00	43.20	947.89	0.00	6.87	4.09	2.76	24.2	0.45	1.00	1.00	0.67	2.15	9.6	19605	0.00	2.00	0.00	1.20	0.00	0	19605	32561
SECC7	37.00	26.80	31.90	869.23	0.00	6.92	3.36	2.16	27.2	0.38	1.00	1.00	0.64	2.34	9.1	18491	0.00	2.00	0.00	1.20	0.00	0	18491	38201
SECC8	26.80	13.82	20.31	764.03	0.00	8.66	4.28	2.56	55.8	0.23	1.00	1.00	0.60	2.85	11.2	24393	0.00	2.00	0.00	1.20	0.00	0	24393	44003
SECC9	13.82	0.84	7.33	625.05	0.00	10.70	4.19	2.46	79.4	0.19	1.00	1.00	0.59	3.03	13.2	24963	0.00	2.00	0.00	1.20	0.00	0	24963	45126

Concentrated Loads for Load Case "WIN 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
4S	813	813	480	0	0	0	
9S	813	813	480	0	0	0	
13S	813	813	480	0	0	0	
18P	710	710	840	0	0	0	
22S	710	710	840	0	0	0	
26S	710	710	840	0	0	0	
34P	764	764	530	0	0	0	
35S	764	764	530	0	0	0	
36S	764	764	530	0	0	0	
38S	780	780	900	0	0	0	
39P	780	780	900	0	0	0	
40S	780	780	900	0	0	0	
41S	780	780	900	0	0	0	
42S	780	780	900	0	0	0	
46S	780	780	900	0	0	0	
47P	780	780	900	0	0	0	
48S	780	780	900	0	0	0	
50S	780	780	900	0	0	0	
51S	780	780	900	0	0	0	

Equipment Load Case Information for "WIN 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 Axial Load (N)	Antenna Side Load (N)	Antenna Moment (MM)	Long. Load (N)	Trans. Load (N)	Vert. Load (N)
ANT.YAG	Ant.Yagui	32.92	877.08	0.00	0.18	315.00							111.63	111.63	312.50
ANT.MW1	Ant.MW03.6	13.82	684.44	0.00	0.00	270.00	-0.01170	-0.34380	-0.13130	-81.50	-2395.01	-3292.82	1635.90	1751.16	4625.00
ANT.MW2	Ant.MW02.8	13.82	684.44	0.00	0.00	90.00	-0.01170	0.34380	0.13130	-49.30	1448.82	1549.28	1059.33	989.61	3750.00
ANT.MW3	Ant.MW04.6	9.48	625.05	0.00	0.00	270.00	-0.01170	-0.34380	-0.13130	-121.53	-3571.30	-6273.98	2439.36	2611.23	6875.00
ANT.MW4	Ant.MW04.8	9.48	625.05	0.00	0.00	90.00	-0.01170	0.34380	0.13130	-132.31	3888.49	7128.20	2843.13	2656.02	7250.00
ANT.MW5	Ant.MW03.6	5.18	625.05	0.00	0.00	180.00	-1.05470	-0.00000	-0.00000	-6709.76	-0.00	-0.00	4744.52	4744.52	4625.00
ANT.MW6	Ant.MW03.6	3.01	625.05	0.00	0.00	135.00	-0.52150	0.45705	0.13905	-3317.66	2907.65	3184.58	3317.67	2907.65	4625.00

EIA Section Load Case Information for "WIN 45-120":

EVALUACION ESTRUCTURAL TAC90



TORRE 90m+EXT.15m

TAC90-E15-ER-MC

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Section Label	Z of Top (m)	Z of Bottom (m)	Ave. Elev. Above Gnd. (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 DE	Face DR	Face RF	Face CF	Face AE (m ²)	Face WF (N)	NotF AAF (m ²)	NotF CAF	NotF AAR (m ²)	NotF CAR	NotF AAR*CAR (m ²)	NotF WA (N)	NotF Wind (N)	Total Weight (N)	Total
EXT1	105.00	92.50	98.75	1200.46	0.00	2.91	0.00	0.00	7.5	0.39	1.20	1.20	0.65	2.31	3.5	9689	0.00	2.00	0.00	1.20	0.00	0	9689	9087	
EXT2	92.50	91.50	92.00	1176.42	0.00	0.23	0.16	0.12	0.7	0.56	1.20	1.20	0.73	1.95	0.4	972	0.00	2.00	0.00	1.20	0.00	0	972	969	
SECC1	91.50	85.50	88.50	1163.45	0.00	2.07	1.98	1.81	4.9	0.82	1.20	1.20	0.91	1.85	4.7	10030	0.00	2.00	0.00	1.20	0.00	0	10030	8020	
SECC2	85.50	84.50	85.00	1150.12	0.00	0.52	0.33	0.28	1.2	0.73	1.20	1.20	0.84	1.82	1.0	2010	0.00	2.00	0.00	1.20	0.00	0	2010	2110	
SECC3	84.50	69.50	77.00	1118.09	0.00	5.52	4.94	3.35	22.8	0.46	1.20	1.20	0.68	2.13	10.6	25406	0.00	2.00	0.00	1.20	0.00	0	25406	19458	
SECC4	69.50	53.50	61.50	1048.54	0.00	6.49	5.27	3.64	24.3	0.48	1.20	1.20	0.69	2.08	12.1	26522	0.00	2.00	0.00	1.20	0.00	0	26522	31208	
SECC5	53.50	49.40	51.45	996.43	0.00	1.48	1.35	0.88	7.1	0.40	1.20	1.20	0.65	2.29	2.8	6449	0.00	2.00	0.00	1.20	0.00	0	6449	10115	
SECC6	49.40	37.00	43.20	947.89	0.00	6.87	4.09	2.76	24.2	0.45	1.20	1.20	0.67	2.15	11.6	23527	0.00	2.00	0.00	1.20	0.00	0	23527	32561	
SECC7	37.00	26.80	31.90	869.23	0.00	6.92	3.36	2.16	27.2	0.38	1.20	1.20	0.64	2.34	10.9	22189	0.00	2.00	0.00	1.20	0.00	0	22189	38201	
SECC8	26.80	13.82	20.31	764.03	0.00	8.66	4.28	2.56	55.8	0.23	1.17	1.17	0.60	2.85	13.2	28636	0.00	2.00	0.00	1.20	0.00	0	28636	44003	
SECC9	13.82	0.84	7.33	625.05	0.00	10.70	4.19	2.46	79.4	0.19	1.14	1.14	0.59	3.03	15.0	28475	0.00	2.00	0.00	1.20	0.00	0	28475	45126	

Concentrated Loads for Load Case "WIN 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
4S	230	230	480	0	0	0	
9S	230	230	480	0	0	0	
13S	230	230	480	0	0	0	
18P	178	178	840	0	0	0	
22S	178	178	840	0	0	0	
26S	178	178	840	0	0	0	
34P	191	191	530	0	0	0	
35S	191	191	530	0	0	0	
36S	191	191	530	0	0	0	
38S	195	195	900	0	0	0	
39P	195	195	900	0	0	0	
40S	195	195	900	0	0	0	
41S	195	195	900	0	0	0	
42S	195	195	900	0	0	0	
46S	195	195	900	0	0	0	
47P	195	195	900	0	0	0	
48S	195	195	900	0	0	0	
50S	195	195	900	0	0	0	
51S	195	195	900	0	0	0	

Equipment Load Case Information for "WIN 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.YAG	Ant.Yagui	32.92	219.26	0.00	0.18	315.00							27.91	27.91	312.50
ANT.MW1	Ant.MW03.6	13.82	171.10	0.00	0.00	270.00	-0.01170	-0.34380	-0.13130	-20.37	-598.72	-823.16	408.95	437.76	4625.00
ANT.MW2	Ant.MW02.8	13.82	171.10	0.00	0.00	90.00	-0.01170	0.34380	0.13130	-12.32	362.18	387.30	264.82	247.39	3750.00
ANT.MW3	Ant.MW04.6	9.48	156.25	0.00	0.00	270.00	-0.01170	-0.34380	-0.13130	-30.38	-892.77	-1568.40	609.80	652.77	6875.00
ANT.MW4	Ant.MW04.8	9.48	156.25	0.00	0.00	90.00	-0.01170	0.34380	0.13130	-33.07	972.06	1781.94	710.74	663.96	7250.00
ANT.MW5	Ant.MW03.6	5.18	156.25	0.00	0.00	180.00	-1.05470	-0.00000	-0.00000	-1677.34	-0.00	-0.00	1186.06	1186.06	4625.00
ANT.MW6	Ant.MW03.6	3.01	156.25	0.00	0.00	135.00	-0.52150	0.45705	0.13905	-829.37	726.87	796.10	829.37	726.87	4625.00

EIA Section Load Case Information for "WIN 45-60":

Section Label	Z of Top (m)	Z of Bottom (m)	Elev. Above Gnd. (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 DE	Face DR	Face RF	Face CF	Face AE (m ²)	Face WF (N)	NotF AAF (m ²)	NotF CAF	NotF AAR (m ²)	NotF CAR	NotF AAR*CAR (m ²)	NotF WA (N)	NotF Wind (N)	Total Weight (N)
EXT1	105.00	92.50	98.75	300.10	0.00	2.91	0.00	0.00	7.5	0.39	1.20	1.20	0.65	2.31	3.5	2422	0.00	2.00	0.00	1.20	0.00	0	2422	9087
EXT2	92.50	91.50	92.00	294.09	0.00	0.23	0.16	0.12	0.7	0.56	1.20	1.20	0.73	1.95	0.4	243	0.00	2.00	0.00	1.20	0.00	0	243	969
SECC1	91.50	85.50	88.50	290.85	0.00	2.07	1.98	1.81	4.9	0.82	1.20	1.20	0.91	1.85	4.7	2507	0.00	2.00	0.00	1.20	0.00	0	2507	8020
SECC2	85.50	84.50	85.00	287.51	0.00	0.52	0.33	0.28	1.2	0.73	1.20	1.20	0.84	1.82	1.0	502	0.00	2.00	0.00	1.20	0.00	0	502	2110
SECC3	84.50	59.50	77.00	279.51	0.00	5.52	4.94	3.35	22.8	0.46	1.20	1.20	0.68	2.13	10.6	6351	0.00	2.00	0.00	1.20	0.00	0	6351	19458
SECC4	69.50	53.50	61.50	262.12	0.00	6.49	5.27	3.64	24.3	0.48	1.20	1.20	0.65	2.08	12.1	6630	0.00	2.00	0.00	1.20	0.00	0	6630	31208
SECC5	53.50	49.40	51.45	249.09	0.00	1.48	1.35	0.88	7.1	0.40	1.20	1.20	0.65	2.29	2.8	1612	0.00	2.00	0.00	1.20	0.00	0	1612	10115
SECC6	49.40	37.00	43.20	236.96	0.00	6.87	4.09	2.76	24.2	0.45	1.20	1.20	0.67	2.15	11.6	5881	0.00	2.00	0.00	1.20	0.00	0	5881	32561
SECC7	37.00	26.80	31.90	217.29	0.00	6.92	3.36	2.16	27.2	0.38	1.20	1.20	0.64	2.34	10.9	5547	0.00	2.00	0.00	1.20	0.00	0	5547	38201
SECC8	26.80	13.82	20.31	191.00	0.00	8.66	4.28	2.56	55.8	0.23	1.17	1.17	0.60	2.85	13.2	7159	0.00	2.00	0.00	1.20	0.00	0	7159	44003
SECC9	13.82	0.84	7.33	156.25	0.00	10.70	4.19	2.46	79.4	0.19	1.14	1.14	0.55	3.03	15.0	7118	0.00	2.00	0.00	1.20	0.00	0	7118	45126

EVALUACION ESTRUCTURAL TAC90



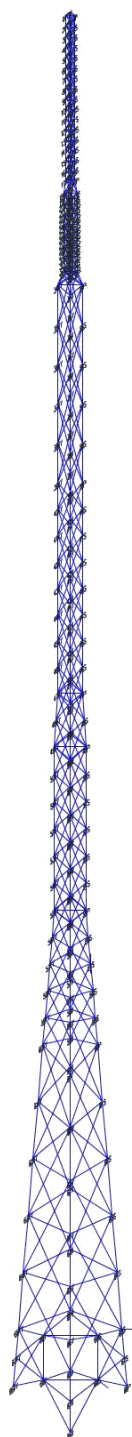
TORRE 90m+EXT.15m

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SILUETA TAC90-NUDOS



EVALUACION ESTRUCTURAL TAC90



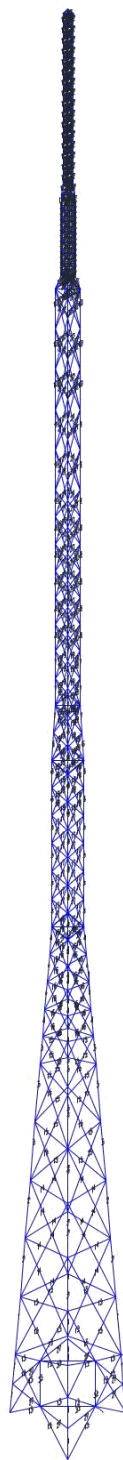
TORRE 90m+EXT.15m

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SILUETA TAC90-ELEMENTOS



EVALUACION ESTRUCTURAL TAC90



TORRE 90m+EXT.15m

TAC90-E15-ER-MC

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RESUMEN

Project Name : TORRE 90.m+EXT.15m - EL RUIZ -ACT.
 Project Notes: BTESA - RTVC
 Project File : f:\arch_2016\eval_btasa\tac90e15el_ruiz\tor90e15ruiz.tow
 Date run : 02:22:28 p.m. Lunes, 23 de mayo de 2016
 by : Tower Version 10.20

Successfully performed linear analysis

The model has 0 warnings.

Member check option: TIA/EIA 222-F
 Connection rupture check: Not Checked
 Crossing diagonal check: Fixed
 Loads from file: f:\arch_2016\eval_btasa\tac90e15el_ruiz\tor90e15ruiz.eia

*** Analysis Results:

Maximum element usage is 336.53% for Angle "28P" in load case "WIN 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)	Vert. Moment (kN-m)	Bending Moment (kN-m)	Found. Usage %
WIN 0 -120	66P	-60.47	-54.22	700.72	81.22	-1.70	-0.23	0.42	1.71	0.00
WIN 0 -120	66X	-58.67	56.03	655.53	81.12	1.30	-0.54	-4.94	1.41	0.00
WIN 0 -120	66XY	-43.11	-32.11	-531.52	53.76	-1.48	-0.62	-2.30	1.60	0.00
WIN 0 -120	66Y	-51.24	45.70	-537.26	68.65	-0.27	-0.95	-1.05	0.99	0.00
WIN 45-120	66P	-82.82	-86.63	1080.68	119.85	-1.19	1.42	-0.47	1.85	0.00
WIN 45-120	66X	-10.29	4.06	71.93	11.06	1.57	-0.89	-5.03	1.80	0.00
WIN 45-120	66XY	-69.15	-68.32	-935.15	97.21	-0.89	0.68	-1.21	1.12	0.00
WIN 45-120	66Y	1.75	-9.23	70.01	9.40	0.88	-1.73	8.73	1.94	0.00
WIN 45-60	66P	-26.43	-29.72	328.11	39.77	-0.48	0.59	-0.01	0.76	0.00
WIN 45-60	66X	-7.77	8.91	73.19	11.82	0.56	0.03	-1.36	0.57	0.00
WIN 45-60	66XY	-12.00	-11.84	-185.13	16.85	-0.03	-0.01	-0.21	0.03	0.00
WIN 45-60	66Y	6.00	-7.46	71.30	9.58	-0.03	-0.64	2.09	0.64	0.00

Note: Summary of Joint Support Reactions For All Load Cases in Direction of Leg not printed because none of the angle members attached to foundation joints have a group type of 'Leg'.

Overturning Moment Summary For All Load Cases:

Load Case	Transverse Moment (kN-m)	Longitudinal Moment (kN-m)	Resultant Moment (kN-m)
WIN 0 -120	138.603	8519.132	8520.260
WIN 45-120	7074.891	7088.348	10014.927
WIN 45-60	1796.356	1809.626	2549.831

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 Adjust Factor	Face Ar Factor	Dead Load Factor
EXT1	105.000	92.500	68	200	0.60	0.60	7.50	1.0000	1.0000	1.200
EXT2	92.500	91.500	8	14	0.60	0.82	0.71	1.0000	1.0000	1.200
SECC1	91.500	85.500	64	126	0.82	0.82	4.92	1.0000	1.0000	1.200
SECC2	85.500	84.500	8	18	0.82	1.52	1.17	1.0000	1.0000	1.200
SECC3	84.500	69.500	24	60	1.52	1.52	22.80	1.0000	1.0000	1.200
SECC4	69.500	53.500	36	102	1.52	1.52	24.32	1.0000	1.0000	1.200
SECC5	53.500	49.400	12	30	1.52	1.95	7.11	1.0000	1.0000	1.200
SECC6	49.400	37.000	28	78	1.95	1.95	24.18	1.0000	1.0000	1.200
SECC7	37.000	26.800	24	60	1.95	3.39	27.22	1.0000	1.0000	1.200
SECC8	26.800	13.820	16	36	3.39	5.21	55.78	1.0000	1.0000	1.200
SECC9	13.820	0.840	24	60	5.21	7.03	79.39	1.0000	1.0000	1.200

*** 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 loadcase.

Group Summary (Compression Portion):

Group Label	Group Desc.	Angle Type	Angle Size	Steel Strength (MPa)	Max Usage %	Max Use In Control %	Comp. Member	Comp. Force (kN)	Comp. Control Load Case	L/R Capacity (kN)	Comp. Conn. Shear Capacity (kN)	Comp. Conn. Bearing Capacity (kN)	RLX	RLY	RLZ	L/R Length Member (m)	Curve No.	No. Bolts	Of Comp.	
1	M01	DAI	1.6X5/16+6X5/16	344.7	95.38	95.38	1P	-1069.66	45-120	843.251	1683.763	1401.207	1.000	1.000	1.000	37.68	2.178	1	16	
2	M02	DAI	1.5X5/16+5X5/16	344.7	119.19	119.19	5P	-1069.39	45-120	674.625	1683.763	2800.649	0.500	0.500	0.500	45.18	4.357	1	16 NG	
3	M03	DAI	21.5X5/16+5X5/16	344.7	83.49	83.49	7P	-1125.43	7WIN	45-120	1013.547	1262.822	2100.487	0.500	0.500	0.500	44.91	4.330	1	12
4	M04	DAI	21.5X5/16+5X5/16	344.7	91.48	91.48	12P	-1382.38	0WIN	45-120	1136.221	1262.822	2100.487	0.500	0.500	0.500	21.26	2.050	1	12
5	M05	DAI	1.5X5/16+5X5/16	344.7	136.58	136.58	13P	-1374.83	9WIN	45-120	756.864	1262.822	2100.487	0.500	0.500	0.500	21.48	2.071	1	12 NG
6	M06	DAI	1.4X5/16+4X5/16	344.7	135.59	135.59	17P	-1060.66	0WIN	45-120	588.180	1262.822	2100.487	0.500	0.500	0.500	26.82	2.071	1	12 NG
7	M07	DAI	1.4X5/16+4X5/16	344.7	125.05	125.05	20P	-979.05	1WIN	45-120	588.675	841.882	1400.325	0.500	0.500	0.500	26.62	2.056	1	8 NG
8	M08	DAI	1.3X5/16+3X5/16	344.7	144.25	144.25	23P	-807.03	7WIN	45-120	420.668	841.882	700.162	0.500	0.500	0.500	34.54	2.000	1	8 NG
9	M09	DAI	L2.5X3/16+2.5X3/16	344.7	336.53	336.53	28P	-463.54	8WIN	45-120	205.665	525.021	103.566	0.500	0.500	0.500	41.44	2.000	1	6 NG

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10	M10	DAI	L2.5X3/16+2.5X3/16	344.7	182.65	182.65	31P	-251.589WIN	45-120	179.322	525.021	103.566	0.500	0.500	0.500	62.16	3.000	1	6	NG
11	M11	DAI	L2.5X3/16+2X1/8	344.7	141.18	141.18	35P	-194.460WIN	45-120	228.342	525.021	103.566	1.000	1.000	1.000	18.51	0.402	1	6	NG
12	M12	SAE	2.5X2.5X0.1875	344.7	89.66	89.66	50P	-92.299WIN	45-120	77.400	350.014	175.371	1.000	1.000	1.000	80.49	1.012	1	4	
13	D01	SAE	2.5X2.5X0.1875	248.1	94.88	94.88	71Y	-14.663WIN	0 -120	11.619	105.235	87.078	0.750	0.500	0.500	297.79	7.488	6	2	
14	D02	SAE	2.5X2.5X0.1875	248.1	63.25	63.25	73Y	-10.832WIN	0 -120	12.877	105.235	87.078	0.750	0.500	0.500	279.10	7.018	6	2	
15	D03	SAE	2X2X0.1875	248.1	164.07	164.07	79P	-21.116WIN	45-120	9.677	105.235	87.078	0.750	0.500	0.500	283.85	5.681	6	2	NG
16	D04	SAE	2X2X0.1875	248.1	206.22	206.22	90P	-49.871WIN	45-120	18.183	105.235	87.078	1.000	0.500	0.500	186.76	2.927	6	2	NG
17	D05	SAE	2X2X0.1875	248.1	186.83	186.83	92Y	-47.052WIN	45-120	18.936	105.235	87.078	1.000	0.500	0.500	181.50	2.844	6	2	NG
18	D06	SAE	2X2X0.1875	248.1	127.48	127.48	100Y	-32.105WIN	0 -120	18.936	105.235	87.078	1.000	0.500	0.500	181.50	2.844	6	2	NG
19	D07	SAE	2X2X0.1875	248.1	131.27	131.27	109Y	-39.395WIN	45-120	22.501	105.235	87.078	1.000	0.500	0.500	180.23	2.812	6	2	NG
20	D08	SAE	2X2X0.1875	248.1	100.02	100.02	112Y	-43.93WIN	45-120	22.501	105.235	87.078	1.000	0.500	0.500	180.23	2.812	6	2	NG
21	D09	SAE	2X2X0.1875	248.1	129.00	129.00	124Y	-25.490WIN	0 -120	14.857	56.148	58.052	0.750	0.500	0.500	214.60	3.263	6	2	NG
22	D10	SAE	2X2X0.1875	248.1	79.33	79.33	134P	-43.475WIN	45-120	41.206	56.148	58.052	0.750	0.500	0.500	78.86	1.578	3	2	
23	D11	SAE	2X2X0.1875	248.1	27.23	25.93	136YR	-12.533WIN	0 -120	38.746	43.769	36.340	1.000	1.000	1.000	90.99	0.911	3	1	
24	D12	SAE	2X2X0.1875	248.1	24.40	24.40	150YR	-10.264WIN	0 -120	31.623	43.769	36.340	1.000	1.000	1.000	123.04	1.231	6	1	
25	H01	SAE	2.5X2.5X0.1875	248.1	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.000	0	0		
26	H02	SAE	2.5X2.5X0.1875	248.1	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.000	0	0		
27	H03	SAE	2X2X0.1875	248.1	125.84	125.84	173Y	-28.634WIN	0 -120	17.109	43.769	36.340	1.000	1.000	1.000	194.85	1.950	6	1	NG
28	H04	SAE	2X2X0.1875	248.1	86.75	86.75	177Y	-27.918WIN	0 -120	24.199	43.769	36.340	1.000	1.000	1.000	151.88	1.520	6	1	
29	H05	SAE	2X2X0.1875	248.1	50.60	39.33	179P	-19.010WIN	0 -120	40.591	43.769	36.340	1.000	1.000	1.000	81.94	0.820	3	1	
30	H06	SAE	2X2X0.1875	248.1	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.000	0	0		
31	H07	SAE	2X2X0.1875	248.1	24.11	14.44	181R	-6.978WIN	45-120	40.591	43.769	36.340	1.000	1.000	1.000	81.94	0.820	3	1	
32	H08	SAE	2X2X0.1875	248.1	4.36	0.00	198YR	0.000	0.000	44.860	43.769	36.340	1.000	1.000	1.000	59.95	0.600	3	1	
33	C01	SAE	2X2X0.1875	248.1	37.74	37.74	199XY	-4.370WIN	0 -120	8.708	43.769	36.340	1.000	0.500	0.500	303.30	4.753	6	1	
34	C02	SAE	2X2X0.1875	248.1	12.56	12.56	202P	-4.622WIN	45-120	27.671	43.769	36.340	1.000	0.500	0.500	137.16	2.150	6	1	
35	C03	SAE	2X2X0.1875	248.1	18.16	18.16	203P	-6.684WIN	45-120	27.671	43.769	36.340	1.000	0.500	0.500	137.16	2.150	6	1	
36	C04	SAE	2X2X0.1875	248.1	6.13	6.13	206P	-2.962WIN	45-120	45.939	43.769	36.340	1.000	0.500	0.500	54.14	0.849	3	1	

Group Summary (Tension Portion):

Group Label	Group Desc.	Angle Type	Angle Size	Steel Strength (MPa)	Max Usage %	Max Tension In Control Tens. Member	Tension Force (kN)	Tension Control Load Case	Net Tens. Section Capacity (kN)	Conn. Tens. Shear Capacity (kN)	Conn. Tens. Bearing Capacity (kN)	Conn. Tens. Rupture Capacity (kN)	Length No. (m)	Of No. Of Bolts Tens.	Of Holes Diameter (cm)	
1	M01	DAI	L6X5/16+6X5/16	344.7	95.38	73.28	3XY 942.698WIN	45-120	967.267	1683.763	1401.207	0.000	4.330	16	2.000	2.064
2	M02	DAI	L5X5/16+5X5/16	344.7	119.19	90.15	5XY 967.379WIN	45-120	806.835	1683.763	2800.649	0.000	4.357	16	2.000	2.064
3	M03	DAI	215X5/16+5X5/16	344.7	83.45	67.86	6XY 1092.288WIN	45-120	1210.242	1262.822	2100.487	0.000	2.050	12	2.000	2.064
4	M04	DAI	215X5/16+6X5/16	344.7	91.48	81.99	12XY 1319.694WIN	45-120	1210.242	1262.822	2100.487	0.000	2.050	12	2.000	2.064
5	M05	DAI	L5X5/16+5X5/16	344.7	136.58	122.76	13XY 1317.362WIN	45-120	806.835	1262.822	2100.487	0.000	2.071	12	2.000	2.064
6	M06	DAI	L4X5/16+4X5/16	344.7	135.59	117.82	17XY 1004.079WIN	45-120	640.777	1262.822	2100.487	0.000	2.071	12	2.000	2.064
7	M07	DAI	L4X5/16+4X5/16	344.7	125.05	107.64	20XY 917.348WIN	45-120	640.777	841.882	1400.325	0.000	2.056	8	2.000	2.064
8	M08	DAI	L3X5/16+3X5/16	344.7	144.25	120.93	23XY 763.808WIN	45-120	474.887	841.882	700.162	0.000	2.000	8	2.000	2.064
9	M09	DAI	L2. 5X3/16+2. 5X3/16	344.7	336.53	328.76	28XY 452.840WIN	45-120	240.743	525.021	103.566	0.000	2.000	6	2.000	1.749
10	M10	DAI	L2. 5X3/16+2. 5X3/16	344.7	182.65	175.46	31XY 241.684WIN	45-120	240.743	525.021	103.566	0.000	3.000	6	2.000	1.749
11	M11	DAI	L2. 5X3/16+2X1/8	344.7	141.18	127.80	35XY 176.037WIN	45-120	240.743	525.021	103.566	0.000	4.026	6	2.000	1.749
12	M12	SAE	2.5X2.5X0.1875	344.7	89.66	64.08	51XY 87.777WIN	45-120	103.000	350.014	175.371	0.000	4.775	4	2.000	1.749
13	D01	SAE	2.5X2.5X0.1875	248.1	94.88	15.05	68P 14.870WIN	0 -120	74.272	105.235	87.078	0.000	4.131	2	1.000	2.064
14	D02	SAE	2.5X2.5X0.1875	248.1	63.25	8.97	75XY 8.863WIN	45-120	74.272	105.235	87.078	0.000	6.552	2	1.000	2.064
15	D03	SAE	2X2X0.1875	248.1	164.07	28.71	81X 20.598WIN	45-120	53.953	105.235	87.078	0.000	3.835	2	1.000	2.064
16	D04	SAE	2X2X0.1875	248.1	206.22	64.43	89XY 46.237WIN	45-120	53.953	105.235	87.078	0.000	2.927	2	1.000	2.064
17	D05	SAE	2X2X0.1875	248.1	186.83	61.20	91Y 43.915WIN	45-120	53.953	105.235	87.078	0.000	2.844	2	1.000	2.064
18	D06	SAE	2X2X0.1875	248.1	127.48	47.80	100P 34.303WIN	0 -120	53.953	105.235	87.078	0.000	2.844	2	1.000	2.064
19	D07	SAE	2X2X0.1875	248.1	131.27	48.05	107Y 24.479WIN	45-120	53.953	105.235	87.078	0.000	2.512	2	1.000	2.064
20	D08	SAE	2X2X0.1875	248.1	100.02	40.17	114P 28.828WIN	0 -120	53.953	105.235	87.078	0.000	2.512	2	1.000	2.064
21	D09	SAE	2X2X0.1875	248.1	129.00	34.61	124P 25.843WIN	0 -120	58.496	56.148	58.052	0.000	3.363	2	1.000	1.428
22	D10	SAE	2X2X0.1875	248.1	79.33	53.30	134XY 39.801WIN	45-120	58.496	56.148	58.052	0.000	1.578	2	1.000	1.428
23	D11	SAE	2X2X0.1875	248.1	27.23	27.23	137YR 13.158WIN	0 -120	56.203	43.769	36.340	0.000	0.913	1	1.000	1.749
24	D12	SAE	2X2X0.1875	248.1	24.40	17.90	150YR 8.654WIN	0 -120	56.203	43.769	36.340	0.000	1.231	1	1.000	1.749
25	H01	SAE	2.5X2.5X0.1875	248.1	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0
26	H02	SAE	2.5X2.5X0.1875	248.1	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0
27	H03	SAE	2X2X0.1875	248.1	125.84	72.98	173P 35.270WIN	0 -120	56.203	43.769	36.340	0.000	1.950	1	1.000	1.749
28	H04	SAE	2X2X0.1875	248.1	86.75	75.68	177P 36.577WIN	0 -120	56.203	43.769	36.340	0.000	1.520	1	1.000	1.749
29	H05	SAE	2X2X0.1875	248.1	50.60	50.60	179Y 24.456WIN	0 -120	56.203	43.769	36.340	0.000	0.820	1	1.000	1.749
30	H06	SAE	2X2X0.1875	248.1	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0
31	H07	SAE	2X2X0.1875	248.1	24.11	24.11	181P 11.653WIN	45-120	56.203	43.769	36.340	0.000	0.820	1	1.000	1.749
32	H08	SAE	2X2X0.1875	248.1	4.36	4.36	198YR 2.108WIN	0 -120	56.203	43.769	36.340	0.000	0.600	1	1.000	1.749
33	C01	SAE	2X2X0.1875	248.1	37.74	13.33	199X 6.445WIN	0 -120	56.203	43.769	36.340	0.000	4.753	1	1.000	1.749
34	C02	SAE	2X2X0.1875	248.1	12.56	0.36	202X 0.173WIN	45-120	56.203	43.769	36.340	0.000	2.150	1	1.000	1.749
35	C03	SAE	2X2X0.1875	248.1	18.16	12.51	203X 6.048WIN	45-120	56.203	43.769	36.340	0.000	2.150	1	1.000	1.749
36	C04	SAE	2X2X0.1875	248.1	6.13	0.00	207X 0.000	0.000	56.203	43.769	36.340	0.000	0.849	1	1.000	1.749

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TORRE 90 m – EL RUIZ - CALDAS
REFORZAMIENTO

EVALUACION ESTRUCTURAL TAC90



TORRE 90m+EXT.15m

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RESUMEN DE DISEÑO

Project Name : TORRE 90.m+EXT.15m - EL RUIZ -REF.
 Project Notes: BTESA - RTVC
 Project File : f:\arch_2016\eval_btesa\tac90e15el_rui\z\tor90e15rui_r.tow
 Date run : 05:13:11 p.m. martes, 24 de mayo de 2016
 by : Tower Version 10.20

Successfully performed linear analysis

The model has 0 warnings.

Member check option: TIA/EIA 222-F
 Connection rupture check: Not Checked
 Crossing diagonal check: Fixed
 Loads from file: f:\arch_2016\eval_btesa\tac90e15el_rui\z\tor90e15rui.eia

*** Analysis Results:

Maximum element usage is 93.30% for Angle "1P" in load case "WIN 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)	Vert. Moment (kN-m)	Bending Moment (kN-m)	Found. Usage %
WIN 0 -120	66P	-60.86	-53.50	694.11	81.03	-1.80	-0.17	0.33	1.81	0.00
WIN 0 -120	66X	-59.16	55.47	651.20	81.10	1.37	-0.51	-4.52	1.47	0.00
WIN 0 -120	66XY	-40.76	-28.62	-489.73	49.81	-1.50	-0.75	-2.17	1.68	0.00
WIN 0 -120	66Y	-48.52	42.04	-493.02	64.20	-0.26	-1.12	-1.00	1.15	0.00
WIN 45-120	66P	-81.71	-85.51	1058.44	118.27	-1.26	1.51	-0.47	1.97	0.00
WIN 45-120	66X	-12.60	4.69	90.61	13.45	1.70	-0.87	-4.53	1.91	0.00
WIN 45-120	66XY	-65.04	-64.20	-875.17	91.39	-0.86	0.63	-1.18	1.06	0.00
WIN 45-120	66Y	2.39	-11.57	88.69	11.82	0.89	-1.87	8.15	2.07	0.00
WIN 45-60	66P	-27.27	-30.52	336.76	40.93	-0.54	0.65	-0.02	0.85	0.00
WIN 45-60	66X	-9.45	10.13	91.82	13.85	0.64	0.08	-1.24	0.64	0.00
WIN 45-60	66XY	-9.85	-9.69	-155.94	13.82	0.03	-0.07	-0.20	0.08	0.00
WIN 45-60	66Y	7.25	-9.15	89.93	11.67	-0.08	-0.72	1.94	0.73	0.00

Note: Summary of Joint Support Reactions For All Load Cases in Direction of Leg not printed because none of the angle members attached to foundation joints have a group type of 'Leg'.

Overturning Moment Summary For All Load Cases:

Load Case	Transverse Moment (kN-m)	Longitudinal Moment (kN-m)	Resultant Moment (kN-m)
WIN 0 -120	139.180	8178.487	8179.671
WIN 45-120	6786.043	6799.504	9606.437
WIN 45-60	1724.201	1737.472	2447.791

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 Af Adjust Factor	Face Ar Adjust Factor	Dead Load Factor
EXT1	105.000	92.500	68	200	0.60	0.60	7.50	1.0000	1.0000	1.200
EXT2	92.500	91.500	8	14	0.60	0.82	0.71	1.0000	1.0000	1.200
SECC1	91.500	85.500	64	126	0.82	0.82	4.92	1.0000	1.0000	1.200
SECC2	85.500	84.500	8	18	0.82	1.52	1.17	1.0000	1.0000	1.200
SECC3	84.500	69.500	24	60	1.52	1.52	22.80	1.0000	1.0000	1.200
SECC4	69.500	53.500	36	102	1.52	1.52	24.32	1.0000	1.0000	1.200
SECC5	53.500	49.400	12	30	1.52	1.95	7.11	1.0000	1.0000	1.200
SECC6	49.400	37.000	28	78	1.95	1.95	24.18	1.0000	1.0000	1.200
SECC7	37.000	26.800	24	60	1.95	3.39	27.22	1.0000	1.0000	1.200
SECC8	26.800	13.820	16	36	3.39	5.21	55.78	1.0000	1.0000	1.200
SECC9	13.820	0.840	24	60	5.21	7.03	79.39	1.0000	1.0000	1.200

*** 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 loadcase.

Group Summary (Compression Portion):

Group Label	Group Desc.	Angle Type	Angle Size	Steel Strength (MPa)	Max Usage %	Max In Control %	Comp. Member	Comp. Force (kN)	Comp. Control Load Case	L/R Capacity (kN)	Comp. Conn. Capacity (kN)	Conn. Shear Capacity (kN)	Conn. Bearing Capacity (kN)	RLX	RLY	RLZ	L/R Length Member (m)	Curve No.	No. Bolts	Of Comp.
1	M01	DAI	16X5/16+6X5/16	344.7	93.30	93.30	1P	-1046.432	WIN 45-120	843.251	1683.763	1401.207	1.000	1.000	1.000	37.68	2.178	1	16	
2	M02	DAI	215X5/16+5X5/16	344.7	77.10	77.10	5P	-1037.714	WIN 45-120	1011.929	1683.763	2800.649	0.500	0.500	0.500	45.18	4.357	1	16	
3	M03	DAI	215X5/16+5X5/16	344.7	80.42	80.42	7P	-1084.119	WIN 45-120	1013.547	1262.822	2100.487	0.500	0.500	0.500	44.91	4.330	1	12	
4	M04	DAI	215X5/16+5X5/16	344.7	86.76	86.76	12P	-1311.118	WIN 45-120	1136.221	1262.822	2100.487	0.500	0.500	0.500	21.26	2.050	1	12	
5	M05	DAI	215X5/16+5X5/16	344.7	86.52	86.52	13P	-1306.400	WIN 45-120	1135.286	1262.822	2100.487	0.500	0.500	0.500	21.48	2.071	1	12	
6	M06	DAI	214X5/16+4x5/16	344.7	85.93	85.93	17P	-1008.293	WIN 45-120	882.232	1262.822	2100.487	0.500	0.500	0.500	26.82	2.071	1	12	
7	M07	DAI	214X5/16+4x5/16	344.7	82.29	82.29	20P	-921.378	WIN 45-120	882.974	841.882	1400.325	0.500	0.500	0.500	26.62	2.056	1	8	

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8	M08	DAI	213X5/16+3X5/16	344.7	90.51	90.51	23P	-759.583WIN	45-120	630.990	841.882	700.162	0.500	0.500	0.500	34.54	2.000	1	8
9	M09	DAI	2121/2X3/16+3X5/16	344.7	79.21	79.21	28P	-439.197WIN	45-120	416.895	700.028	467.657	0.500	0.500	0.500	37.67	2.000	1	8
10	M10	DAI	2121/2X3/16+3X1/4	344.7	53.95	53.95	31P	-241.314WIN	45-120	336.286	700.028	467.657	0.500	0.500	0.500	56.51	3.000	1	8
11	M11	DAI	2121/2X3/16+3X1/4	344.7	34.53	34.53	35P	-190.764WIN	45-120	415.423	700.028	467.657	1.000	1.000	1.000	15.15	0.402	1	8
12	M12	SAE	2.5X2.5X0.1875	344.7	90.19	90.19	50P	-92.844WIN	45-120	77.400	350.014	175.371	1.000	1.000	1.000	80.49	1.012	1	4
13	D01	SAE	2.5X2.5X0.1875	248.1	91.88	91.88	71Y	-14.200WIN	0 -120	11.619	105.235	87.078	0.750	0.500	0.500	297.79	7.488	6	2
14	D02	SAE	2.5X2.5X0.1875	248.1	65.00	65.00	73Y	-11.133WIN	0 -120	12.878	105.235	87.078	0.750	0.500	0.500	279.10	7.018	6	2
15	D03	DAE	2X2X0.1875	248.1	75.58	75.58	79P	-20.967WIN	45-120	20.857	105.235	174.156	0.750	0.500	0.500	271.89	5.681	6	2
16	D04	DAE	2X2X0.1875	248.1	75.57	75.57	90P	-54.514WIN	45-120	54.238	105.235	174.156	0.750	0.500	0.500	140.07	2.927	6	2
17	D05	DAE	2X2X0.1875	248.1	65.57	65.57	92Y	-49.083WIN	45-120	56.282	105.235	174.156	0.750	0.500	0.500	136.12	2.844	6	2
18	D06	DAE	2X2X0.1875	248.1	42.21	42.21	102Y	-31.723WIN	0 -120	56.512	105.235	174.156	0.750	0.500	0.500	135.69	2.835	6	2
19	D07	DAE	2X2X0.1875	248.1	45.97	45.97	108Y	-39.913WIN	45-120	65.282	105.235	174.156	0.750	0.500	0.500	120.22	2.512	6	2
20	D08	DAE	2X2X0.1875	248.1	32.95	32.95	112Y	-28.606WIN	0 -120	65.282	105.235	174.156	0.750	0.500	0.500	120.22	2.512	6	2
21	D09	DAE	2X2X0.1875	248.1	39.35	39.35	124Y	-23.584WIN	0 -120	45.068	56.148	116.104	0.750	0.500	0.500	160.95	3.363	6	2
22	D10	SAE	2X2X0.1875	248.1	71.11	71.11	128Y	-19.947WIN	0 -120	21.092	56.148	58.052	0.750	0.500	0.500	168.03	3.363	6	2
23	D11	SAE	2X2X0.1875	248.1	26.56	25.02	138YR	-12.091WIN	0 -120	38.692	43.769	36.340	1.000	1.000	1.000	91.25	0.913	3	1
24	D12	SAE	2X2X0.1875	248.1	24.55	24.55	150XR	-10.327WIN	0 -120	31.623	43.769	36.340	1.000	1.000	1.000	123.04	1.231	6	1
25	H01	SAE	2.5X2.5X0.1875	248.1	0.00	0.00		0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.000	0	0
26	H02	SAE	2.5X2.5X0.1875	248.1	0.00	0.00		0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.000	0	0
27	H03	SAE	2.5X2.5X0.1875	248.1	67.98	59.10	173Y	-23.966WIN	0 -120	30.488	43.769	36.340	1.000	1.000	1.000	155.09	1.950	6	1
28	H04	SAE	2X2X0.1875	248.1	72.12	72.12	177Y	-23.211WIN	0 -120	24.199	43.769	36.340	1.000	1.000	1.000	151.88	1.520	6	1
29	H05	SAE	2X2X0.1875	248.1	55.03	44.00	179P	-21.265WIN	0 -120	40.591	43.769	36.340	1.000	1.000	1.000	81.94	0.820	3	1
30	H06	SAE	2X2X0.1875	248.1	0.00	0.00		0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.000	0	0
31	H07	SAE	2X2X0.1875	248.1	24.16	14.37	181R	-6.943WIN	45-120	40.591	43.769	36.340	1.000	1.000	1.000	81.94	0.820	3	1
32	H08	SAE	2X2X0.1875	248.1	4.36	0.00	198YR	0.000		44.860	43.769	36.340	1.000	1.000	1.000	59.95	0.600	3	1
33	C01	SAE	2X2X0.1875	248.1	37.41	37.41	199XY	-4.332WIN	0 -120	8.708	43.769	36.340	1.000	0.500	0.500	303.30	4.753	6	1
34	C02	SAE	2X2X0.1875	248.1	12.55	12.55	202P	-4.620WIN	45-120	27.671	43.769	36.340	1.000	0.500	0.500	137.16	2.150	6	1
35	C03	SAE	2X2X0.1875	248.1	14.63	14.63	203P	-5.386WIN	45-120	27.671	43.769	36.340	1.000	0.500	0.500	137.16	2.150	6	1
36	C04	SAE	2X2X0.1875	248.1	6.11	6.11	206P	-2.955WIN	45-120	45.939	43.769	36.340	1.000	0.500	0.500	54.14	0.849	3	1

Group Summary (Tension Portion):

Group Label	Group Desc.	Angle Type	Angle Size	Steel Strength (MPa)	Max Usage %	Max Tension Use In Control %	Tension Force (kN)	Tension Control Load Case	Net Tens. Section Capacity (kN)	Conn. Tens. Shear Capacity (kN)	Conn. Tens. Bearing Capacity (kN)	Conn. Tens. Rupture Capacity (kN)	Length Member (m)	No. Of Holes	No. Of Bolts	Hole Diameter (cm)
1	M01	DAI	1.6X5/16+6X5/16	344.7	93.30	68.44	3XY 880.446WIN	45-120	967.267	1683.763	1401.207	0.000	4.330	16	2.000	2.064
2	M02	DAI	2.1X5/16+6X5/16	344.7	77.10	56.03	5XY 901.832WIN	45-120	1210.242	1683.763	2800.649	0.000	4.357	16	2.000	2.064
3	M03	DAI	2.1X5/16+6X5/16	344.7	80.42	63.27	8XY 1018.343WIN	45-120	1210.242	1262.822	2100.487	0.000	2.050	12	2.000	2.064
4	M04	DAI	2.1X5/16+6X5/16	344.7	86.76	76.19	12XY 1224.550WIN	45-120	1210.242	1262.822	2100.487	0.000	2.050	12	2.000	2.064
5	M05	DAI	2.1X5/16+6X5/16	344.7	86.52	76.19	13XY 1226.447WIN	45-120	1210.242	1262.822	2100.487	0.000	2.071	12	2.000	2.064
6	M06	DAI	2.1X4X5/16+6X5/16	344.7	85.93	72.76	17XY 930.047WIN	45-120	961.124	1262.822	2100.487	0.000	2.071	12	2.000	2.064
7	M07	DAI	2.1X4X5/16+6X5/16	344.7	82.29	75.52	20XY 845.653WIN	45-120	961.124	841.882	1400.325	0.000	2.056	8	2.000	2.064
8	M08	DAI	2.1X3X5/16+6X5/16	344.7	90.51	75.73	23XY 705.186WIN	45-120	712.317	841.882	700.162	0.000	2.000	8	2.000	2.064
9	M09	DAI	2.1X2.1/2X3/16+6X5/16	344.7	79.21	67.78	28XY 421.604WIN	45-120	478.194	700.028	467.657	0.000	2.000	8	2.000	1.749
10	M10	DAI	2.1X2.1/2X3/16+6X3X1/4	344.7	53.95	39.86	31XY 229.472WIN	45-120	432.900	700.028	467.657	0.000	3.000	8	2.000	1.749
11	M11	DAI	2.1X2.1/2X3/16+6X3X1/4	344.7	34.53	31.75	46XY 98.734WIN	45-120	432.900	350.014	233.829	0.000	0.402	4	2.000	1.749
12	M12	SAE	2.5X2.5X0.1875	248.1	90.19	64.48	51XY 88.327WIN	45-120	103.000	350.014	175.371	0.000	0.775	4	2.000	1.749
13	D01	SAE	2.5X2.5X0.1875	248.1	91.88	15.31	68P 15.11SWIN	0 -120	74.272	105.235	87.078	0.000	4.131	2	1.000	2.064
14	D02	SAE	2.5X2.5X0.1875	248.1	65.00	8.11	75XY 8.010WIN	45-120	74.272	105.235	87.078	0.000	6.552	2	1.000	2.064
15	D03	DAE	2X2X0.1875	248.1	75.58	14.39	81X 20.136WIN	45-120	123.616	105.235	174.156	0.000	3.835	2	1.000	2.064
16	D04	DAE	2X2X0.1875	248.1	75.57	34.40	90XY 48.153WIN	45-120	123.616	105.235	174.156	0.000	2.927	2	1.000	2.064
17	D05	DAE	2X2X0.1875	248.1	65.57	31.23	91Y 43.705WIN	45-120	123.616	105.235	174.156	0.000	2.844	2	1.000	2.064
18	D06	DAE	2X2X0.1875	248.1	42.21	23.77	100P 33.268WIN	0 -120	123.616	105.235	174.156	0.000	2.844	2	1.000	2.064
19	D07	DAE	2X2X0.1875	248.1	45.97	23.74	107Y 33.234WIN	45-120	123.616	105.235	174.156	0.000	2.512	2	1.000	2.064
20	D08	DAE	2X2X0.1875	248.1	32.95	19.56	114P 27.372WIN	0 -120	123.616	105.235	174.156	0.000	2.512	2	1.000	2.064
21	D09	DAE	2X2X0.1875	248.1	39.35	31.72	124P 23.691WIN	0 -120	128.158	56.148	116.104	0.000	3.363	2	1.000	1.428
22	D10	SAE	2X2X0.1875	248.1	71.11	43.57	134XY 32.533WIN	45-120	58.496	56.148	58.052	0.000	1.578	2	1.000	1.428
23	D11	SAE	2X2X0.1875	248.1	26.56	26.56	137YR 12.838WIN	0 -120	56.203	43.769	36.340	0.000	0.913	1	1.000	1.749
24	D12	SAE	2X2X0.1875	248.1	24.55	17.98	150YR 8.690WIN	0 -120	56.203	43.769	36.340	0.000	1.231	1	1.000	1.749
25	H01	SAE	2.5X2.5X0.1875	248.1	0.00	0.00		0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	
26	H02	SAE	2.5X2.5X0.1875	248.1	0.00	0.00		0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	
27	H03	SAE	2.5X2.5X0.1875	248.1	67.98	67.98	173P 32.856WIN	0 -120	76.521	43.769	36.340	0.000	1.950	1	1.000	1.749
28	H04	SAE	2X2X0.1875	248.1	72.12	66.60	177P 32.189WIN	0 -120	56.203	43.769	36.340	0.000	1.520	1	1.000	1.749
29	H05	SAE	2X2X0.1875	248.1	55.03	55.03	179Y 26.596WIN	0 -120	56.203	43.769	36.340	0.000	0.820	1	1.000	1.749
30	H06	SAE	2X2X0.1875	248.1	0.00	0.00		0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	
31	H07	SAE	2X2X0.1875	248.1	24.16	24.16	181P 11.678WIN	45-120	56.203	43.769	36.340	0.000	0.820	1	1.000	1.749
32	H08	SAE	2X2X0.1875	248.1	4.36	4.36	198YR 2.109WIN	0 -120	56.203	43.769	36.340	0.000	0.600	1	1.000	1.749
33	C01	SAE	2X2X0.1875	248.1	37.41	13.22	199X 6.390WIN	0 -120	56.203	43.769	36.340	0.000	4.753	1	1.000	1.749
34	C02	SAE	2X2X0.1875	248.1	12.55	0.64	202X 0.310WIN	45-120	56.203	43.769	36.340	0.000	2.150	1	1.000	1.749
35	C03	SAE	2X2X0.1875	248.1	14.63	10.45	203X 5.051WIN	45-120	56.203	43.769	36.340	0.000	2.150	1	1.000	1.749
36	C04	SAE	2X2X0.1875	248.1	6.11	0.00	207X 0.000WIN	45-120	56.203	43.769	36.340	0.000	0.849	1	1.000	1.749

TORRE 90 m – EL RUIZ - CALDAS
CIMENTACION

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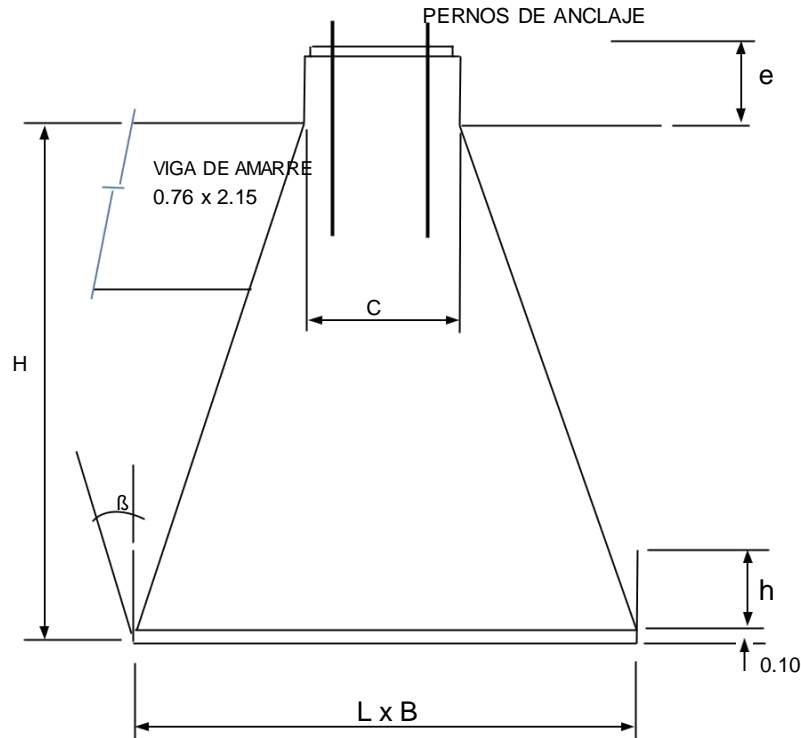
TORRE 90m+EXT.15m

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TORRE 90,m - EL RUIZ
CIMENTACION EN CONCRETO



MATERIALES: Acero $f_y = 4,200$ Kg / cm²
 Concr. $f'_c = 210$ Kg / cm²
 Angulo $\beta = 18$ grados. $T_g = 0.325$
 Suelo $q_u = 1.00$ Kg / cm²
 Suelo $C = 0.10$ Kg / cm²

PREDIMENSIONAMIENTO. CHEQUEO ESTABL.

Dimensiones (m.)	H =	h =	C =	L =	e =
	2.80	0.50	1.20	4.10	0.60
Volumen de Concreto (m3)	V1 =	V2 =	V3 =	Vc =	Cortante Vu=
	4.104	8.405	0.841	13.35	
Volumen de Suelo (m3)	V4 =	V5 =	V6 =	Vs =	
	47.068	20.149	2.299	56.167	11,827
Peso Específico (Ton / m3)	Suelo	Concreto	R. Cohesión	P. Suelo	P. Concreto
	1.70	2.40	22.960	95.484	32.039
Peso total Fundación (Ton.)	150,482	Arrancamiento	Factor de seguridad al		
		$F_u =$	arranque K=	1.46	
Compresión	C =	Area m2		Presión sobre el terreno	
	105,844	16.81	0.49	Kg / cm2	

EVALUACION ESTRUCTURAL TAC90



TORRE 90m+EXT.15m

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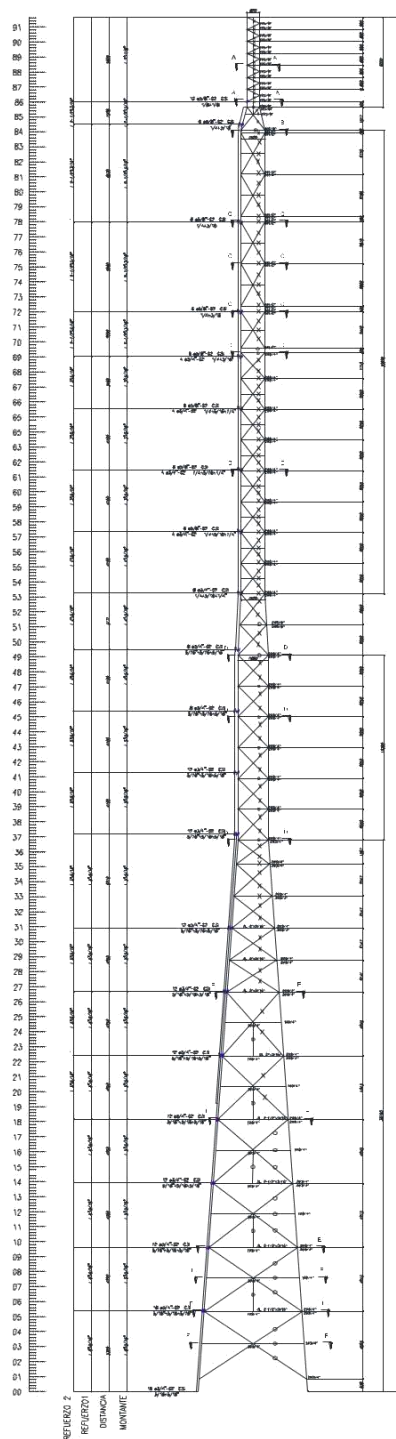
CONCLUSIONES:

La torre de 90 metros instalada en sitio El Ruiz-Manizales (Caldas), en el estado actual 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 336.53%, referido al límite fluencia, fallan los elementos M02, M05 de 2L5"x5/16", M06, M07 de 2L4"x5/16", M08 de 2L3"x5/16", M09, M10 de 2L2-1/2"x3/16", M11 de L2-1/2"x3/16"+L2"x1/8" y D03 a D09 de L2"x3/16", 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 las torre, para cargas de trabajo, con viento de 60.km/h es 1.05 m, es decir 0.57 ° mayor a 0.5°, lo que supone inestabilidad estructural por deformación.
4. Se propone un refuerzo para los elementos M02, M05 con 1L5"x5/16", M06, M07 con 1L4"x5/16", M08 con 1L3"x5/16", M09, M10 con 1L3"x1/4", M11 con 1 L2-1/2"x3/16" y D03 a D09 con L2"x3/16", además de hacer cierre interno entre estas diagonales para mejorar la esbeltez; El peso aprox. de la extensión de 15 metros mas el reforzamiento es 9.200 kg.
5. La cimentación, según el informe de campo, está compuesta por zapatas cuadradas de 4.1m, con pedestales de 1.20x1.20 (piramidales) a una profundidad de 2.80 metros, unidos mediante vigas de amarre de 0.76x2.15m, con suelo $q_a=1.0 \text{ kg/cm}^2$ y según la verificación, la cimentación cumple por esfuerzos para las cargas de la torre con las antenas nuevas.

EVALUACION ESTRUCTURAL TAC90

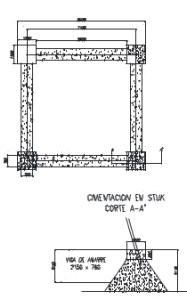
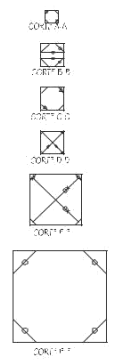
		TORRE 90m+EXT.15m		
		TAC90-E15-ER-MC	HOJA 25 / 26	REV. 0



CONVERSIONES	
1/4"	6.35 mm
1/2"	12.7 mm
3/4"	19.0 mm
1"	25.4 mm
1 1/2"	38.1 mm
2"	50.8 mm
2 1/2"	63.5 mm
3"	76.2 mm
3 1/2"	88.9 mm
4"	101.6 mm
4 1/2"	114.3 mm
5"	127.0 mm
5 1/2"	140.0 mm
6"	152.4 mm
6 1/2"	165.1 mm
7"	177.8 mm
7 1/2"	190.5 mm
8"	203.2 mm
8 1/2"	215.9 mm
9"	228.6 mm
9 1/2"	241.3 mm
10"	254.0 mm
10 1/2"	266.7 mm
11"	279.4 mm
11 1/2"	292.1 mm
12"	304.8 mm
12 1/2"	317.5 mm
13"	330.2 mm
13 1/2"	342.9 mm
14"	355.6 mm
14 1/2"	368.3 mm
15"	381.0 mm
15 1/2"	393.7 mm
16"	406.4 mm
16 1/2"	419.1 mm
17"	431.8 mm
17 1/2"	444.5 mm
18"	457.2 mm
18 1/2"	469.9 mm
19"	482.6 mm
19 1/2"	495.3 mm
20"	508.0 mm
20 1/2"	520.7 mm
21"	533.4 mm
21 1/2"	546.1 mm
22"	558.8 mm
22 1/2"	571.5 mm
23"	584.2 mm
23 1/2"	596.9 mm
24"	609.6 mm
24 1/2"	622.3 mm
25"	635.0 mm
25 1/2"	647.7 mm
26"	660.4 mm
26 1/2"	673.1 mm
27"	685.8 mm
27 1/2"	698.5 mm
28"	711.2 mm
28 1/2"	723.9 mm
29"	736.6 mm
29 1/2"	749.3 mm
30"	762.0 mm
30 1/2"	774.7 mm
31"	787.4 mm
31 1/2"	800.1 mm
32"	812.8 mm
32 1/2"	825.5 mm
33"	838.2 mm
33 1/2"	850.9 mm
34"	863.6 mm
34 1/2"	876.3 mm
35"	889.0 mm
35 1/2"	901.7 mm
36"	914.4 mm
36 1/2"	927.1 mm
37"	939.8 mm
37 1/2"	952.5 mm
38"	965.2 mm
38 1/2"	977.9 mm
39"	990.6 mm
39 1/2"	1003.3 mm
40"	1016.0 mm
40 1/2"	1028.7 mm
41"	1041.4 mm
41 1/2"	1054.1 mm
42"	1066.8 mm
42 1/2"	1079.5 mm
43"	1092.2 mm
43 1/2"	1104.9 mm
44"	1117.6 mm
44 1/2"	1130.3 mm
45"	1143.0 mm
45 1/2"	1155.7 mm
46"	1168.4 mm
46 1/2"	1181.1 mm
47"	1194.8 mm
47 1/2"	1207.5 mm
48"	1220.2 mm
48 1/2"	1232.9 mm
49"	1245.6 mm
49 1/2"	1258.3 mm
50"	1271.0 mm
50 1/2"	1283.7 mm
51"	1296.4 mm
51 1/2"	1309.1 mm
52"	1321.8 mm
52 1/2"	1334.5 mm
53"	1347.2 mm
53 1/2"	1359.9 mm
54"	1372.6 mm
54 1/2"	1385.3 mm
55"	1398.0 mm
55 1/2"	1410.7 mm
56"	1423.4 mm
56 1/2"	1426.1 mm
57"	1441.8 mm
57 1/2"	1457.5 mm
58"	1468.2 mm
58 1/2"	1478.9 mm
59"	1494.6 mm
59 1/2"	1507.3 mm
60"	1523.0 mm
60 1/2"	1536.7 mm
61"	1552.4 mm
61 1/2"	1566.1 mm
62"	1581.8 mm
62 1/2"	1595.5 mm
63"	1610.2 mm
63 1/2"	1623.9 mm
64"	1642.6 mm
64 1/2"	1656.3 mm
65"	1675.0 mm
65 1/2"	1688.7 mm
66"	1708.4 mm
66 1/2"	1721.1 mm
67"	1744.8 mm
67 1/2"	1757.5 mm
68"	1774.2 mm
68 1/2"	1787.9 mm
69"	1807.6 mm
69 1/2"	1821.3 mm
70"	1842.0 mm
70 1/2"	1855.7 mm
71"	1876.4 mm
71 1/2"	1890.1 mm
72"	1914.8 mm
72 1/2"	1928.5 mm
73"	1948.2 mm
73 1/2"	1961.9 mm
74"	1985.6 mm
74 1/2"	1999.3 mm
75"	2018.0 mm
75 1/2"	2031.7 mm
76"	2054.4 mm
76 1/2"	2064.1 mm
77"	2080.8 mm
77 1/2"	2096.5 mm
78"	2117.2 mm
78 1/2"	2128.9 mm
79"	2145.6 mm
79 1/2"	2161.3 mm
80"	2180.0 mm
80 1/2"	2192.7 mm
81"	2208.4 mm
81 1/2"	2216.1 mm
82"	2234.8 mm
82 1/2"	2248.5 mm
83"	2266.2 mm
83 1/2"	2280.9 mm
84"	2302.6 mm
84 1/2"	2313.3 mm
85"	2329.0 mm
85 1/2"	2326.7 mm
86"	2345.4 mm
86 1/2"	2339.1 mm
87"	2361.8 mm
87 1/2"	2351.5 mm
88"	2378.2 mm
88 1/2"	2363.9 mm
89"	2394.6 mm
89 1/2"	2376.3 mm
90"	2394.6 mm
90 1/2"	2376.3 mm
91"	2394.6 mm
91 1/2"	2376.3 mm



NOTA: MONUMENTOS DE REFUERZO UNIDOS CON SILABADURA
EN DIAGONALES Y ENTRE MONUMENTO Y REFUERZO



EVALUACION ESTRUCTURAL TAC90



TORRE 90m+EXT.15m

TAC90-E15-ER-MC

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