DESIGN STANDARDS

Use 30 psf on two times the projected area of the exposed face with cylindrical surfaces taken at $\frac{2}{3}$ the projected area

1) Top - Section #5 : 1"OD $1\frac{1}{4}$"x$\frac{1}{8}$" bars @ $18\frac{1}{2}$"oc $\frac{1}{8}$"x$\frac{3}{8}$" X-bracing, $13\frac{7}{8}$" span

Vertical: $2 \times 12 \times \frac{2}{3} = 16.0$ $\boxed{\text{B}}$

Horiz: $1.25 \times 13.875 \times \frac{12}{18.5} = 11.2$

Bracing: $2 \times .375 \times 23.1 \times \frac{12}{18.5} = 11.4$

$38.6 \times \frac{2 \times 30}{144} = $ 16.1 #/L.F

2) Next - Section #6 : $1\frac{1}{4}$"OD $1\frac{1}{2}$"x$\frac{1}{8}$" bars @ $18\frac{1}{2}$"oc $\frac{1}{8}$"x$\frac{1}{2}$" X-bracing, 18" span

Vertical: $2 \times 1.25 \times 12 \times \frac{2}{3} = 20.0$ $\boxed{\text{B}}$

Horiz: $1.5 \times 18.0 \times \frac{12}{18.5} = 17.5$

Bracing: $2 \times 0.5 \times 25.7 \times \frac{12}{18.5} = 16.7$

$54.2 \times \frac{2 \times 30}{144} = $ 22.6 #/L.F.

3) Next - Section #7 : $1\frac{1}{4}$"OD $1\frac{1}{2}$"x$\frac{1}{8}$" @ $18\frac{1}{2}$"oc $\frac{1}{8}$"x$\frac{1}{2}$" X-bracing, 22" span

Vertical: $= 20.0$ $\boxed{\text{B}}$

Horiz: $1.5 \times 22 \times \frac{12}{18.5} = 21.4$

Bracing: $2 \times 0.5 \times 28.7 \times \frac{12}{18.5} = 18.7$

$60.1 \times \frac{2 \times 30}{144} = $ 25.0 #/L.F

4) Next - Section #8 : $1\frac{1}{4}$"OD $1\frac{1}{2}$"x$\frac{3}{16}$" @ $18\frac{1}{2}$"oc $\frac{1}{8}$"x$\frac{3}{4}$" X-bracing, 26" span

Vertical: $= 20.0$ $\boxed{\text{B}}$

Horiz: $1.5 \times 26 \times \frac{12}{18.5} = 25.3$

Bracing: $2 \times 0.75 \times 32 \times \frac{12}{18.5} = 31.1$

$76.4 \times \frac{2 \times 30}{144} = $ 31.7 #/L.F.

Dead Load of Tower = 1050#

D.L. of Antenna = 200# @ 5'-0" max. above tower

Antenna Wind = 50#

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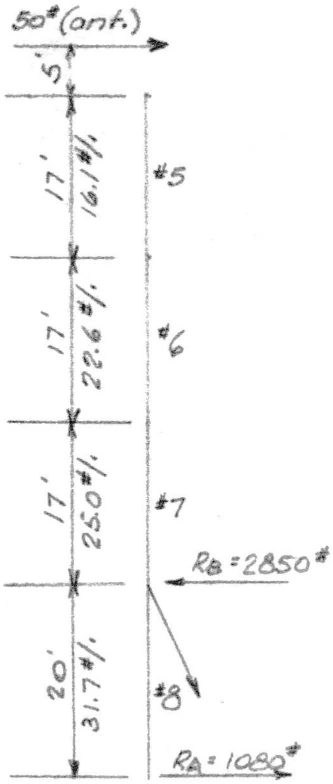

ΣM_B =	50(56)	=	2,800.
	16.1(17)(42.5)	=	11,700.
	22.6(17)(25.5)	=	9,800.
	25.0(17)(8.5)	=	3600
			27,900
	31.7(20)(10)		6400
			21,500'# = $20R_A$; R_A = 1080#

ΣM_A =	50 (76)	=	3800.
	16.1 (17) 62.5	=	17,100.
	22.6 (17) 45.5	=	17,500.
	25.0 (17) 28.5	=	12,100.
	31.7 (20) 10.0	=	6400.
			56,900'# = $20R_B$; R_B = 2850#

Check: 634 + 63.7(17) + 50 + 1080 = 2850
2844 ≅ 2850 OK

H_{XB} = 1.155(2850) = 3290# H_{YB} = .577(2850) = 1650#

Use an initial rod tension of 750#; Horiz. comp = $750\left(\frac{7.19}{20}\right)$ = 270#
Assume 25% relief due to wind deflection.

Est. H_{ZB} = 270 − 68 = 202#
" H_{YB} = 1650 + 202 = 1850#
" H_{XB} = 3290 + 202 = 3490#

Check tower sections

In Section #8, below tripod connection
Tripod vertical = 5540 × 2.78 = 15400#

Axial load = 900 + 200 + 60 + 15,400 = $\frac{16560}{3}$ = 5520#/leg

Max M occurs in Section #8, 3'-0" below top:
M = 1080(17) + 31.7(17)8.5 = 23000'#; $V_c = \frac{23000 \times 12}{21.4}$ = 12900#

Allow F_A: $\frac{L}{R} = \frac{20 \times 12}{10.1}$ = 23.8 ; F_A = 16.7 ksi

$f_a = \frac{5520}{.627+.166}$ = 6970 psi $f_b = \frac{12900}{.627+.166}$ = 16300 psi

$\frac{6970}{16700} + \frac{16300}{20000}$ = 1.23 < 1.33 OK

Use 7/8"φ x .065" x 8'-0" insert in top of section

In Section #7, at tripod connection M = 27,900'# $V_c = \frac{27900 \times 12}{17.91}$ = 18,700#
P = 900 + 200 + 60 = $\frac{1160}{3}$ = 390#/leg (negligible)

$f_b = \frac{18700}{.627+.166}$ = 23,600 < 26,600 OK

Use 7/8"φ x .065 x 8'-0" insert in bottom of section

In Section #6, at bottom: $\Sigma M = 50(39) + 16.1(17)(25.5) + 22.6(7)8.5 = 12,200$ '#

$V_c = \frac{12,200 \times 12}{14.5} = 10,100\#$, $f_b = \frac{10,100}{.2427.191} = 23,300 < 26600$

Use 1"φ x .065" x 10'-0" insert in bottom of section. Fasten tubes with $\frac{5}{16}$" φ plug welds (Total 10)

$\frac{5}{16}$"φ plug welds:– In shear: $2 \times .077 \times 13,600 \times 1.33 = 2780$ #/weld
In bearing: $2 \times .313 \times .065 \times 26,600 = 1080$ #/weld

No. of welds req'd: $\frac{10,100}{1080} = 10$

In Section #5, at bottom: $\Sigma M = 50(22) + 16.1(17)8.5 = 3500$ '#

$V_c = \frac{3500 \times 12}{11.1} = 3780\#$; $f_b = \frac{3780}{.191} = 19800$ psi
For 1¼"φ ; $f_b = \frac{3780}{.242} = 15700$ psi

Check plane of bracing:
In Sect #8, max. panel shear $= \frac{2}{3}[1080 + 640] = 1150\#$; $P = 1150 \times \frac{32}{26} = 1410\#$

Tension bracing $= \frac{1410}{1.5 \times .188} = 5000$ psi

Lacing: $\frac{L}{R} = \frac{24.75}{.246} = 100$; $f = \frac{1150}{.242} = 4750$ psi

Check lap detail: Compression occurs in Sect #7 in lap

$P = \frac{2}{3} \times \frac{27900}{3} = 6200\#$; $\frac{L}{R} = \frac{20.75 - .62}{.153} = 132$

Use light-gauge standards; $\frac{w}{T} = 8$; $Q = 1$

Allowable $\frac{P}{A} = \frac{134 \times 10^6}{132^2} = 10,250 \times 1.33 = 13700$; $f_a = \frac{6200}{.489} = 12700$

Tension $= 6200 \times \frac{28.7}{22} = 8090\#$; $f_t = \frac{8090}{.188 \times 1.75} = 24500 \cong 24000$

Load on tower footing $= 1050 + 200 + 60 + 15400 + 2500 = 19200\#$

Use 2'-6" x 2'-6" x 2'-6" footing   Soil Pressure $= \frac{19200}{6.25} = 3070$ #/□

Allowable for medium clay $= 2300 \times 1.33 = 3100$ #/□

Tripod footing: Critical tripod leg $H_{xB} = 3490\#$ $V_{xB} = 9660\#$

Use 3'-6" x 3'-6" x 5'-6" deep footing   D.L. of concrete = 10,100#

Frictional resistance $= 4 \times 3.5 \times 5.5 \times 500 = 37,500\#$ (Use ½ DL as max)

1.5 DL > 1.5 (9660)

Frictional resistance to sliding will alone resist horiz. component

Check tripod leg connection to tower P = 10300#

In leg, $\frac{P}{A} = \frac{10300}{.247.19} = 24700 < 26600$

¾"φ bolt D.S. $= 8.84 \times 1.33 = 11.8k$; B'r'g in ½" plate $= 9.0 \times 1.33 = 12^k$

Weld req'd $= \frac{10300}{600 \times \frac{4}{3}} = 13"$ Use 13" of ⅛" fillet weld

Check #6 re-bar : $f_s = \frac{10300}{.44} = 23400 < 26600$

Check details of HZR (Rotating Model):

Base. Tripod load will have distributed itself over all three legs at base.

$M = 5520 \times 14 = 77400''^{\#}$ $f_b = \frac{77400}{4.16} = 18600$ psi

Rotating ring. (Must span between bearings)

Max. tripod leg, $V_{xB} = 9660^{\#}$; $M = \frac{9660}{4}(10.62) = 25700''^{\#}$

$f_b = \frac{25700}{1.13} = 22800$ psi $< 26,600$

Tower ring: (Must span between legs) (Use continuous span coeff'ts)

$M = .208\,(9660)\,24.75 = 49700''^{\#}$, $f_b = \frac{49700}{1.89} = 26400 < 26,600$