STRESS ANALYSIS - PARABOLIC FRAME

Wind load Base on pressure of 20 lb/ft² (70 mph nominal)

Layout Assume truss shown opposite, and 24 trusses in all

Area of segment = $\frac{1}{24} \times .7854 \times 60^2 = 118$ ft²

load = 20 × 118 = 2360 lb.

Sharing the loads on the sections in proportion to the areas 3 : 5 : 7 and applying one half to each joint, the loads at the joints are distributed as $1\frac{1}{2} : 1\frac{1}{2}+2\frac{1}{2} : 2\frac{1}{2}+3\frac{1}{2} : 3\frac{1}{2}$

$= 1\frac{1}{2} : 4 : 6 : 3\frac{1}{2} = 240 : 630 : 950 : 550$. These loads will be applied parallel to the axis ~~Horizontal~~ perpendicular components also exist which make the net load normal to the surface.

	550	950	630	240	TOTAL	
U1	-2000	-2500	-1100	-800	-5700	lb
U2	-2000	-2100	-600		-4200	
U3	-2000	-1500	0		-3500	
U4	-2000	0	0		-2000	
B1	2300	2600	800		5000	
B2	2300	1900	0		4200	
B3	2300	0	0		2300	
B4	2300	0	0		2300	
T1	1200	1600	800	500	4100	
T2	0	-300	400			
T3	0	-400	0			
T4	0	0	0			
D1	0	600	700	900	2200	
D2	0	900	1100		2000	
D3	0	2100	0		2100	

Allowable compression on steel radio towers (Federal Hdbk p. 937) 17000 lb/in²

Cross section area required for 5700 lb load is .33 in².
When the wind is blowing from the reverse direction the sign of the stresses is reversed. If we use 2" dia × 1/16" wall tubing throughout, which has an area of 0.4 in², we will be about right.
By reducing weight of lightly stressed members we might save 25%.