A STUDY OF THE EFFECT OF VARIATIONS IN ANCHOR SPACING, LEG SPACING, AND GUY ATTACHMENT SPACING ON THE STRUCTURAL ECONOMY OF TALL GUYED TOWERS, WITH A CRITICAL DISCUSSION OF TOWER DESIGN PRINCIPLES

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Approved:

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SYMBOLS

a_o — distance from base of mast to outer guy anchor

a_i — distance from base of mast to inner guy anchor

h — height from base of mast to a guy level

d — mast movement at guy level in the direction of the wind

D — the leg spacing on the mast

L_G — actual guy length

L_c — chord length of inclined guy

L — span length on the mast between the guy attachment levels

Δ — sag at midpoint of guy

c — chord length of horizontal guy

μ — horizontal displacement of the mast at a guy level

α — angle between the guy chord and the horizontal

w — weight per unit length of guy

p — wind force per unit length of guy

W_G — total weight of a guy

F — wind load on the mast at a guy level

P — axial force on the mast at a guy level

Q — one-half the weight of a guy

S — total external force at guy level on mast

T — tensile force in guy

V ———— vertical component of guy force

H ———— horizontal component of guy force

S_{oj} ———— reaction at mast level j with mast on rigid supports

S_{fj} ———— final reaction at mast level j

N ———— the number of guy attachment levels on the mast

K_j ———— spring constant at mast level j

K ———— force required to produce a displacement μ at a guy level

M_{ej} ———— moment at level j due to eccentricity of the vertical guy components

$M_{jj\,below}$ ———— moment carried to level j from below due to all M_{ej} below j

$M_{jj\,above}$ ———— moment carried to level j from above due to all M_{ej} above j

$M_{j\,below}$ ———— final distributed moment below level j

$M_{j\,above}$ ———— final distributed moment above level j

M_{jk} ———— moment at level j due to a unit load at level k

X_{jk} ———— reaction at mast level j due to a unit displacement at level k, all other supports being held

Y_{jk} ———— reaction at mast level j due to unit force at level k, all other supports being held

Z_{jk} ———— reaction at level j due to non-linearity of supports

Ω_{jk} ———— force at level j for a unit displacement at level k

SUMMARY

The purpose of the investigation was to study the effect on the mast weight of guyed vertical towers of variations in (a) the spacing of the anchors for the guy strands, (b) the vertical spacing of the points of guy attachment to the mast, and (c) the spacing between the legs of the mast. The investigation was conducted by programming the Fiesenheiser method of design for guyed aerial towers for solution on an electronic computer and then obtaining data for 354 tower designs. By analysis of the data, it was possible to compare the mast weight of each of the towers with the variable parameters.

Of the 354 towers studied, 144 were 500 feet high, 105 were 700 feet high, and 105 were 900 feet high. At a given height various combinations of anchor spacing, guy attachment spacing, and leg spacing were used. For example, for the towers 700 feet high comparisons were made with three different leg spacings, five different arrangements of the points of guy attachment to the mast, and seven arrangements for the anchor spacing. For the towers 900 feet high, the number of trial leg spacings, guy attachment spacings, and anchor spacings was three, five, and seven, respectively. However, for the towers 500 feet high, comparison was made for three leg spacings with six guy attachment arrangements, and eight anchor arrangements.

In order to present the results graphically, a set of curves was drawn which compare mast weight against guy arrangement and leg spacing for each of the anchor arrangements. This results in a set of figures with three curves on each figure; each of the curves represents

one possible trial leg spacing. Horizontal coordinates represent guy attachment arrangements; ordinates represent mast weight. Inspection of each figure shows not only the arrangement which results in the least mast weight for those combinations shown by the figure, but also shows the trend in the mast weight as the guy attachment spacing and the leg spacing is varied. Since there is one figure for each anchor arrangement, the comparison of mast weight with anchor location may be made by checking all of the figures for a given mast height.

Finally, a set of empirical equations was formulated by comparing the trends in the mast weight with tower height, as influenced by variations in each of the parameters. These equations may be used to obtain preliminary trial values for leg spacing, guy attachment spacing, and anchor spacing. Since the tower heights in the study varied between 500 feet and 900 feet, the equations are recommended for use in the design of guyed aerial towers in which the tower heights vary between those levels.

These equations do not give exact values for the parameters suitable for all tower designs. It was assumed in the study that the mast cross-section was triangular, that the structural members of the mast were composed of ASTM A-7 steel pipe, that the wind load on the mast followed a definite pattern varying from 50 pounds per square foot at the top of the mast to 40 pounds per square foot at the bottom of the mast, that five guy levels were used with three guys spaced 120° apart at each level, and that each mast carried a standard six-bay television antenna cantilevered 103 feet above the top of the mast. It is intended that the equations be used only as a guide so that the number of design trials may be reduced to a minimum by the selection of values for the parameters investigated in the study which are reasonably close to the final design configuration.

The conclusions of the study are summarized by the following empirical equations:

1. For determination of the anchor location, use

$$a = 0.8\, h$$

where a = the distance in feet from the base of the mast to the anchor

h = the height in feet from the base of the mast to the point of attachment on the mast of the top set of guys connected to that anchor.

2. For determination of the guy spacing no equation is necessary. It is recommended that the points of guy level attachment to the mast be spaced equally along the length of the mast.

3. For determination of the leg spacing, use

$$D = \frac{H}{200} + 2.5 \qquad 500 < H < 900$$

where D = the leg spacing in feet

H = the total mast height in feet

4. In order to estimate mast weight, use

$$W = 0.2\, H - 70 \qquad 500 < H < 900$$

where W = the mast weight in kips

H = the total mast height in feet

CHAPTER I

INTRODUCTION

The design of tall guyed towers (Fig. 1)* is a trial and error process in that it is first necessary to assume a preliminary design in order to determine the stresses in a guyed tower. The effect of variations can only be determined by analyzing several designs. A great amount of time and labor is involved in this process since the tower design problem is more complex than the design problem of ordinary building structural frames. The usual methods of structural mechanics cannot be used because the displacements in towers (usually neglected in building analysis) may increase the stresses which, in turn, continue to amplify the displacements. In addition, several major variables are involved in the design, and each of these variables has a pronounced effect on the internal forces in the structure. As a result, each of the variable factors plays its part in the choice of guy sizes, and in the choice of structural members used in the mast.

Five of the most important variable factors are (a) the spacing of the anchors for the guy strands, (b) the vertical spacing of the points of guy attachment to the mast, (c) the spacing between the legs of the mast, (d) the number of points of guy attachment to the mast, and (e) the size of the antenna.

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*Numbers in parentheses indicate references listed in the "Literature Cited" section in the bibliography.

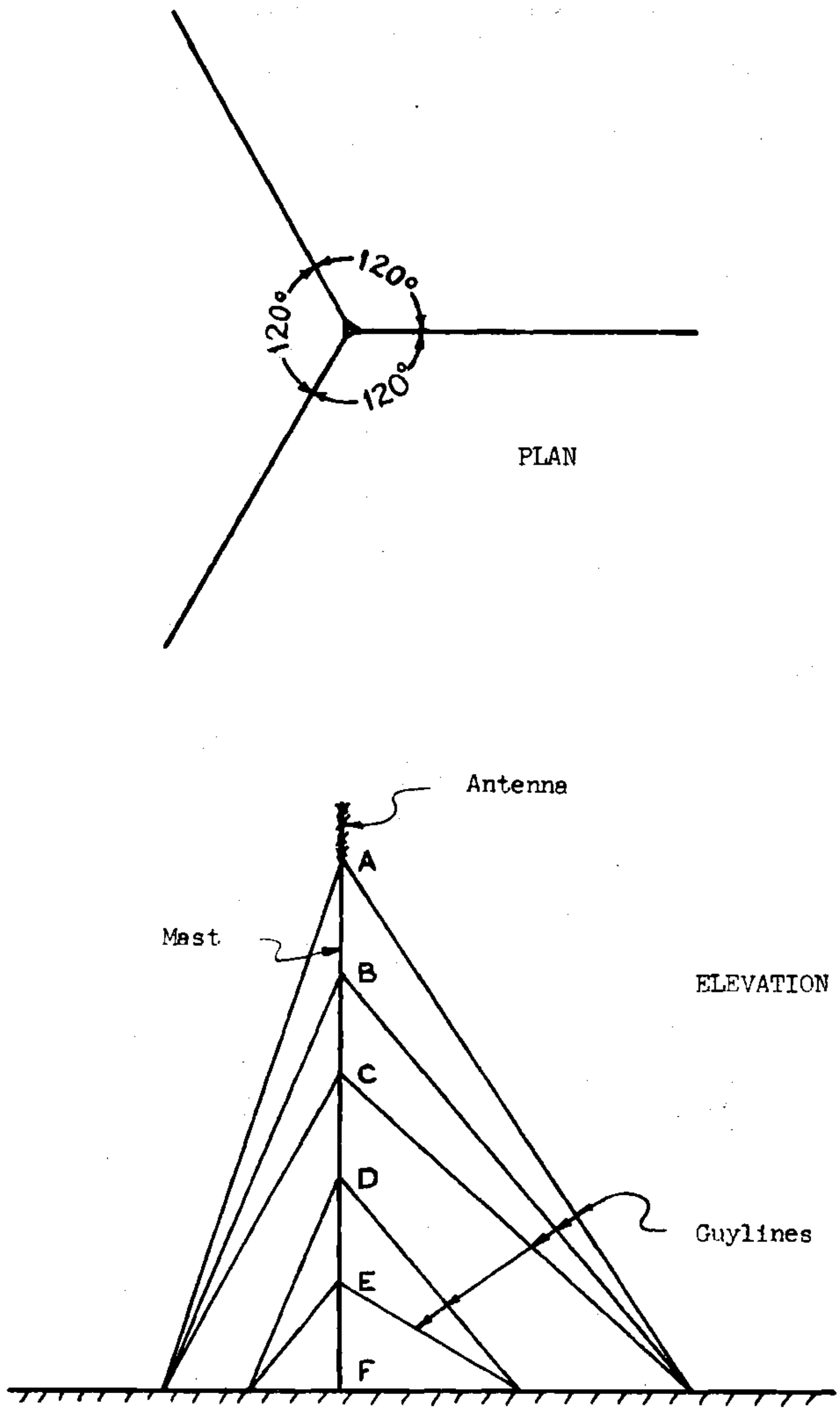


Figure 1   Antenna, Mast, and Guy Supports for Guyed Vertical Tower

In assuming a preliminary design the size of the antenna is usually fixed by other than structural requirements. To reduce the number of trials necessary to produce an economical design, it would be helpful for the tower designer to be able to predict reasonable values for the first four of the variables listed above.

The purpose of this investigation is to study the effect on the mast weight of the guyed tower of variations in (a) the spacing of the anchors for the guy strands, (b) the vertical spacing of the points of guy attachment to the mast, and (c) the spacing between the legs of the mast.

Due to limitations on computer programming and computer operating time, the study was conducted with only one antenna size used throughout the investigation. It was also assumed that each tower had guylines attached at five levels. The scope of the study was further limited to the structural analysis of the most common type of tall guyed tower (i.e., a tower with a mast of triangular cross-section and with three guys spaced 120° apart at each level).

The analysis, based on Fiesenheiser's approach as explained in Chapter 2, was adapted for use on an electronic computer. Three hundred fifty four separate tower designs were processed through the computer, with the heights of the towers ranging from five hundred to nine hundred feet above the base of the tower. Each tower was assumed to carry a typical television antenna cantilevered one hundred three feet above the top of the mast, with the result that the total heights of mast and antenna ranged from six hundred three feet to one thousand three feet.

In order to portray the results graphically, a set of curves was drawn which show the variation of mast weight with leg spacing and guy arrangement for each of the anchor arrangements. Finally, conclusions were drawn in the form of a set of empirical equations which may be used as a guide in the selection of preliminary design values for leg spacing, guy attachment spacing on the mast, and anchor spacing. Limitations on the equations are discussed in Chapter IV.

CHAPTER II

TOWER ANALYSIS PRINCIPLES AND PROCEDURES

Guyed towers represent a combination of rigid and elastic systems in equilibrium. The relatively slender mast (Fig. 2) is supported by a network of even more slender guys. The mast is an axially loaded beam column with many elastic supports.

Under ordinary circumstances, the horizontal wind loads are the major loads to be considered in the design. Structural shapes which offer minimum resistance to the wind should be used for the members of the mast. In this investigation steel pipe was assumed as the basic structural shape for all members of the mast. Cylindrical shapes offer minimum resistance to the wind; this has been verified experimentally by numerous wind tunnel tests (2).

When the winds deflect the tower mast laterally, the guys on the windward side stretch elastically while the sag of the leeward guys increases. Each set of three guys provides a support whose movement is governed by the size of the guy wires, their length, initial tension, angle of inclination to the vertical, and the pattern of the guying system.

Continuous beams (trusses) on fixed supports are complex in that their analysis requires use of the principles of indeterminacy. In addition, when the supports deflect under load, so that differential movement exists between supports, the analysis becomes even more complex.

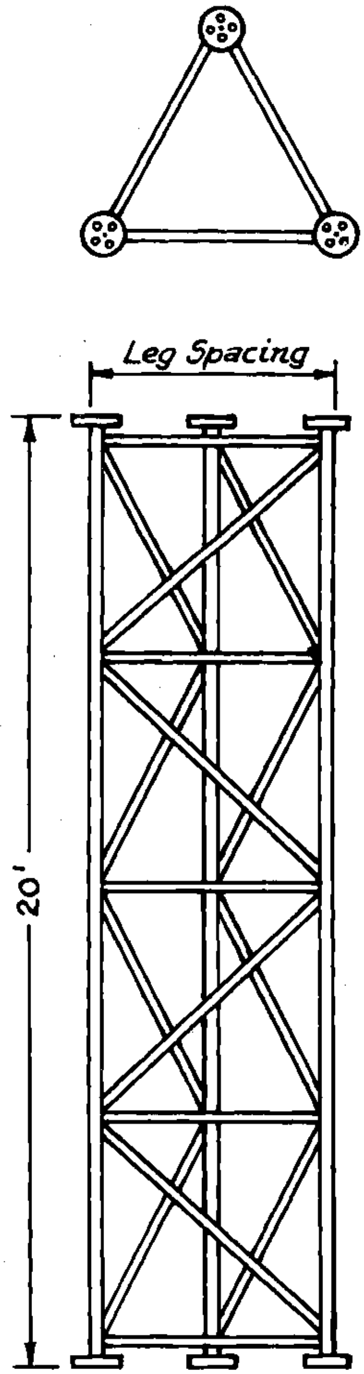


Figure 2   Typical Tower Section

The mast is a trussed framework of legs, diagonals, and horizontal web members. The framework acts as a beam column in that the legs carry the bending and direct loads, and the web members carry the shear. The mast must carry the vertical components of the guy forces and must resist shear and bending moment produced by horizontal wind loading over its entire length. These are combined with the bending moment and shear carried to the top of the mast by the antenna. The vertical direct stresses increase from top to bottom of the mast due to the dead load and to the successive addition of the vertical components of the forces in the guys.

In order to allow the mast to lean under the action of the wind without having bending moment developed at the base, the usual procedure provides a tapered bottom section for the mast that rests on what is essentially a point support; indeed, some towers have even been placed on spherical seats in order to achieve the desired effect. On the other hand, there is no reason why the legs cannot be carried straight down to the footing and fixed in place if the bending moments are properly accounted for in the analysis and design.

If an obstacle is placed in the path of the wind, all or part of the kinetic energy of the moving air is transformed into the potential energy of pressure. The intensity of the pressure depends upon the shape of the obstacle, the angle of incidence to the wind, and the velocity and density of the air (3).

On a multilevel guyed tower the loads due to wind velocity are affected by the shape of the tower, and, in the case of a non-circular and trussed tower, by the orientation of the tower to the direction of the wind, the ratio of the solid area to the total enclosed area of a vertical face, and the cross-sectional shape of the individual members of the tower.

It is necessary to determine a design wind at the specific location of the tower. The final choice of a wind loading is inevitably a judgment decision that should be based on available evidence consistent with past experience in the area. The design wind must be considered regarding the following characteristics:

(a) basic wind velocity

(b) gust factor

(c) variation of average velocity and gust factors with height

The basic wind velocity has been defined as the one minute average velocity at a height of thirty feet and the design wind velocity as the basic wind velocity times the gust factor.

After the selection of the design wind velocity, and the pattern of wind pressures on the mast, the wind forces on the structure must be computed. Since the wind force is not the same on all shapes, the first step must be to establish the proper shape coefficients for the member being used (4). There is general agreement that trusses composed of members with circular cross-section offer minimum resistance to the wind. However, there is only a very limited amount of test data available for trusses with such members. Cohen & Perrin conclude that the wind load on trusses composed of members with circular cross-section, should be 2/3 of those composed of flat members and that this current common practice is on the safe side (2).

When two trusses are placed one behind the other, the forces acting on the leeward truss are reduced. Present codes specify that the load on towers of triangular cross-section shall be 1.5 times the load on one face (7).

Computation of wind loads follows the given series of steps:

(a) Choose the design wind velocity and appropriate gust factor

(b) Determine a realistic variation in the wind velocity with height

(c) Wind force equations are based on wind blowing on flat plates. Choose the proper shape factor for the structural members being used

(d) Compute the wind force per linear foot of tower, making proper allowance for the shape of the cross-section of the tower.

The axial loads on the mast are derived principally from three sources:

(a) the vertical components of the guy tensions

(b) the dead load, including guy weight, the weight of the antenna, the weight of the mast, ladder, lines, and other accessories

(c) ice load.

Depending on the location of the tower, the primary axial loading on the mast may consist of the vertical components of the guy tensions and the weight of the mast. The vertical components of the guy forces are a function of the design wind, the inclination of the guys, the number of guys, and the pattern of the guying system. The sum of the vertical components of the guy forces will often exceed the mast weight by a considerable amount.

The tables in Appendix B show clearly the effect of the inclination of the guy on maximum tension in the guy, and correspondingly, the vertical component of the force. In general, the further the anchor lies from the base of the tower, the smaller the vertical component of the guy tension.

The dead load consists principally of the weight of the mast plus the weight of the antenna. It is not unusual for the heavier television antennae to weigh in the neighborhood of ten tons. The legs of the mast are the heaviest portion of the mast proper. Choice of leg size is also a function of many variable factors. One of these which has a direct relationship to leg size is the number of guy levels used. An increase in the number of guy levels will often result in a decrease in leg size, and vice versa.

Provision must be made for the added weight of ladders, coaxial cables to the antenna, cable for the lighting system, lights, elevators, etc.

Finally, in certain climates, provision must be made for ice load. Most codes specify that from one-half to one inch of ice shall be assumed to cover all members. It would be unrealistic to assume this ice load covering on the guys, together with full wind load. Judgment must be used to properly evaluate ice loadings, since at sixty pounds per cubic foot an ice coat has substantial weight. In fact, more experimental data is needed on the effect of ice loads on guyed towers.

All three items of axial load must be determined before one can proceed with the design of the mast. The dead load values should be predicted as accurately as possible, with the final design checked to see that it conforms with the predicted values.

The Design Method of Cohen and Perrin. - - Cohen and Perrin have presented the most comprehensive and general treatment of guyed tower design (5). The following approach summarizes their recommendations.

The structural analysis of a multi-level guyed tower consists of six steps:

Step 1. Analysis of the mast considered as a continuous beam-column on rigid supports

Step 2. Determination of the spring constants of the guys, i.e., the resultant horizontal reaction of each set of guys per unit deflection of their upper connection

Step 3. Re-analysis of the mast as a continuous beam-column on elastic supports

Step 4. When the wind force acts on the mast, the mast moves with the wind, causing the guys on the windward side to become more taut. At the same time, the tension is decreased in the guys on the leeward side, etc. while their sag increases. The relaxation in force, which takes place as the point of attachment of the leeward guy to the mast displaces horizontally, is an essential quantity in the analysis of the guy action. Since the forces acting in the various guys attached at the same level become unequal, the resultant of the vertical components of the guy forces is eccentric with respect to the centroid of the mast. A moment is introduced at every guy level the effect of which must be considered in the design.

Step 5. Under wind action, unless special precautions are taken in the design, the horizontal deflection of the mast at each guy level will be of such a nature that a straight line will no longer pass through each of these points. A distortion of the mast results, and additional flexure is introduced. The effect of this distortion on the bending moments must be computed.

Step 6. If the wind forces are eccentric with respect to the axis of the tower because of unsymmetrical exposed areas, a torsional effect is introduced. This effect must be considered if such exposed areas exist.

The mechanics of the solution to the tower design problem will be explained in detail by following the six steps of Cohen & Perrin in the order in which they are stated above.

In Step 1, because of the influence of the axial load, the mast is analyzed as a beam-column. The vertical loads which consist of the dead weight, vertical components of the guy forces, and the ice load are assumed to be concentrated at the guy level.

Analysis of the mast may follow the general principles of moment distribution. To account for the axial loads, the fixed-end moments, stiffness factors, and carry-over factors are modified by considering the slenderness and axial load in each span of the mast as a function of L/j, where L is the span length and $j = \frac{EI}{P}$, where P is the axial force. The required factors for analysis of end moments are shown in Fig. 3 (6).

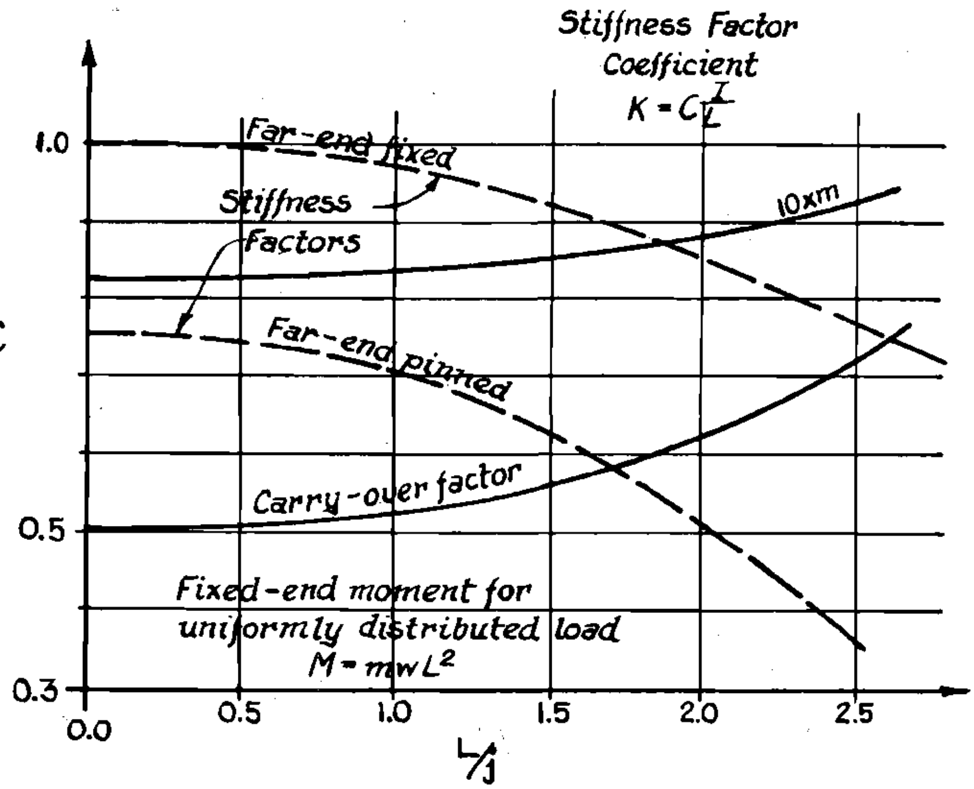


Figure 3 Moment Distribution Coefficients for Axial Compression Combined with Bending

If the moments are desired along the span, they may be computed from the equation

$$M = C_1 \sin \frac{x}{j} + C_2 \cos \frac{x}{j} + f(\omega) \qquad (1)$$

with the coefficients for typical cases shown in Fig. 4 (6).

when x is equal to c, $W = 2Q =$ total load, and the other terms are as explained above. Integrating ds along a parabola yields the equation for length

$$L = c\left(1 + \frac{8\Delta^2}{3c^2}\right) \tag{10}$$

Equation 10 consists of the first two terms of a power series expansion; since the ratio Δ/c is small, the terms involving higher orders of the ratio have been eliminated. The elongation due to a change of tensile force dH is

$$e = \frac{c\,dH}{AE}\left(1 + \frac{8\Delta^2}{3c^2}\right) \tag{11}$$

obtained by substituting in the standard equation for elongation e From equation 9,

$$\Delta = \frac{Qc}{4H} = \frac{Wc}{8H}$$

and substituting in equation 10, we obtain

$$L = c\left(1 + \frac{W^2}{24H^2}\right) = \left(\frac{24H^2 + W^2}{24H^2}\right)c$$

The chord length c can then be expressed as

$$c = \frac{24H^2 L}{24H^2 + W^2} \tag{12}$$

After differentiating with respect to H, the change in chord length dc becomes

$$dc = -\frac{cW^2}{24}\left(\frac{1}{H_1^2} - \frac{1}{H_2^2}\right) + \frac{c}{AE}\,dH \tag{13}$$

where H_1 is the final tension in the guy, and H_2 is the initial tension.

With Q = W/2, and substituting Q = W/2 into Equation 13, we obtain

$$d_c = -\frac{cQ^2}{6}\left(\frac{1}{H_1^2} - \frac{1}{H_2^2}\right) + \frac{c}{AE}\left(H_1 - H_2\right) \tag{14}$$

These equations for horizontal guys are valid for inclined guys if the sag is measured normal to the chord, and the other terms measured accordingly. Since the normal component of the sag (Fig. 6) is

$$\Delta_N = \Delta \cos \alpha$$

then the horizontal motion Δ_a of the top connection of a single inclined guy is (Fig. 6)

$$\begin{aligned} \Delta_a &= \Delta_c \sec \alpha \\ &= -\frac{cQ^2}{6 \cos \alpha}\left(\frac{1}{T_1^2} - \frac{1}{T_2^2}\right) + \frac{c}{AE}\left(T_1 - T_2\right) \sec \alpha \end{aligned} \tag{15}$$

where Q is the reaction normal to the chord and T the tension acting at the center point.

In the case of guyed towers, where three or more guys are attached at the same level, the secondary effects for temperature change in the guys and the mast very nearly cancel out with respect to motion of the tower. The final tensions in the guys, and thereby the axial load in the mast, are only slightly affected. Since the wind loads can, at best, only be approximated, temperature effects usually need not be considered (5).

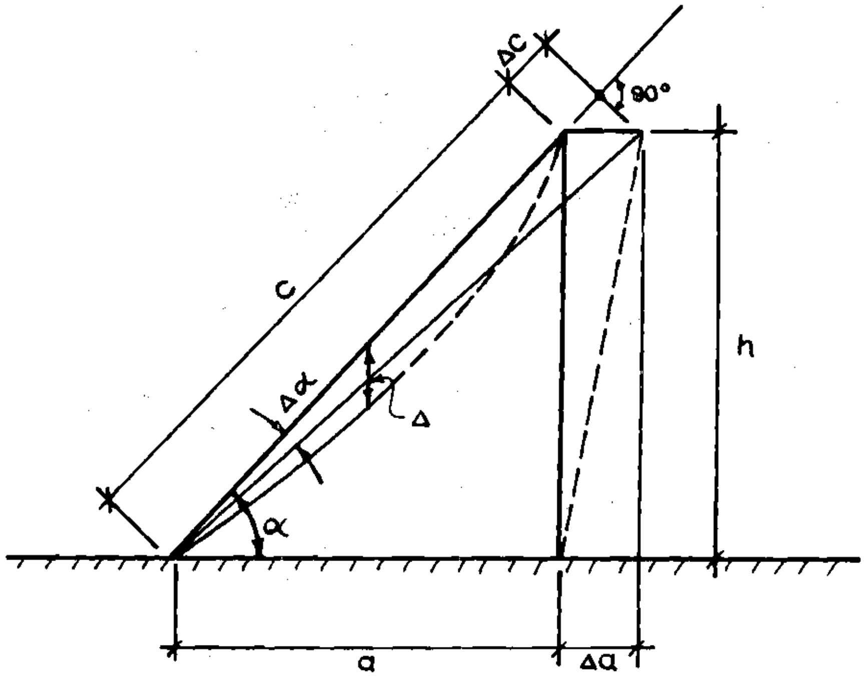


Figure 6 Motion of the Upper Guy Connection

In order to determine the spring constants for the elastic supports of the mast, the behavior of a set of guys attached at the same level must be investigated.

Since the guys meet at a common level and location at their upper ends, these ends must move as a unit. To analyze this motion graphically, when the wind direction is normal to one face, the following equations may be developed from the geometry of the movement (Fig. 7)

$$dx = dy \tag{16}$$

$$dx + dy = 2\,dx = dz \tag{17}$$

The displacement dz of the leeward guy connection in the direction of the leeward guy is twice the magnitude of the displacement dx. The tower displaces in the z direction by the amount dz.

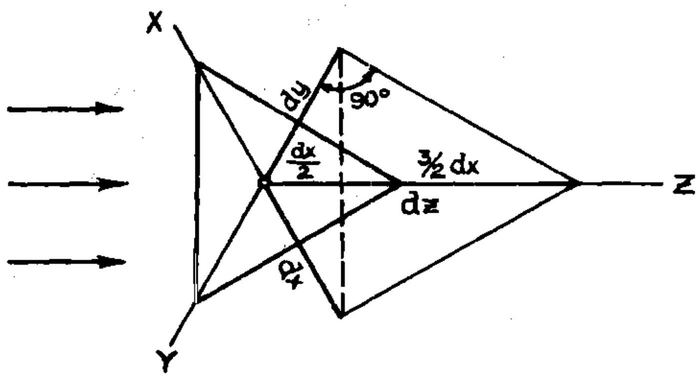


Figure 7 Motion of a Set of Guys with Wind Normal to one Face

Cohen & Perrin use a graphical method to determine the displacement of a three guy connection due to a horizontal load applied at the connection. The two equilibrium conditions are the compatibility of displacement between the windward and leeward guys, and the equilibrium between external and internal forces.

The displacement of all three guys may be plotted as a function of the tension in the guys. First, in equation form, using equation 15 and equation 16,

$$\Delta a_1 = dx + dy = -\frac{2cQ_x^2}{6\cos\alpha}\left(\frac{1}{T_{1x}^2} - \frac{1}{T_{2x}^2}\right) + \frac{2c}{AE}\left(T_{1x} - T_{2x}\right)\sec\alpha \qquad (18)$$

$$\Delta a_2 = dz = -\frac{cQ_z^2}{6\cos\alpha}\left(\frac{1}{T_{1z}^2} - \frac{1}{T_{2z}^2}\right) + \frac{c}{AE}\left(T_{1z} - T_{2z}\right)\sec\alpha$$

with Δ_{a_1} the displacement of the windward guys as a function of their tension, and Δ_{a_2} the displacement of the leeward guy as a function of its tension. The two equilibrium conditions are fulfilled when

$$\Delta_{a_1} = \Delta_{a_2}$$

The graphical solution of equations 18 is obtained as follows:

A. Plot Δ_{a_1} and Δ_{a_2} on coordinate axes with $dz = dx + dy$ as the ordinate and average guy tension as the abscissa. To do this, choose a guy level on the mast to investigate. Assume a guy size and initial tension for the guys. All quantities on the right hand side of equations 18 are now known except T_1, the final tension. Assume values for T_1, compute values for Δ_a, and plot. See Figure 8 for a typical example. This plot must be repeated for every guy level on the mast. Note: After the final tension values are found later in the design procedure it will probably be necessary to repeat the above process several times until the assumed guy sizes are found to be the most economical, and yet satisfactory with regard to working stress and horizontal displacement of the guy level on the mast. If alternate anchor locations are investigated, the entire procedure must be repeated for every trial, since α, the inclination of the guys, will change each time the anchor is shifted. Repeated trials are also necessary if the initial tension is varied or the number of guy levels is changed.

B. Shift the horizontal axis parallel to itself by drawing it through the point on the curve for the windward guys which represents their tension under initial tension plus wind load on the guys only. This value may be computed by modifying Q in equation 15 assuming no movement of the mast.

C. Compute the initial tension plus wind load tension on the leeward guy. Plot the mirror image of the curve for Δ_{a_2} through the intersection of this value with the new abscissa axis.

D. The external force, S/cos α , is plotted between the two curves above. S equals the horizontal force applied at the guy level plus the horizontal reaction due to wind blowing on the guys.

The points intercepted on the two curves by the above plot satisfy both equilibrium conditions, i.e., compatibility of displacements and equilibrium of forces. The ordinate is the displacement of the mast at the guy level for which the diagram was drawn. The external force is distributed among the windward and leeward guys. The external force S at the connection may be equated with the change in tension in the guys.

$$S = \sum \Delta H = \sum \Delta T \cos \alpha \qquad (19)$$

The detail in Figure 8 shows that the tower deflects into the wind if wind on the guys only is considered. This happens because of the increase in tension in the windward guys and the decrease in tension in the leeward guy. For this reason, the effect of the wind on the guys is that it increases their resistance to motion of the mast.

E. The external force, S, is distributed to the windward and the leeward guys. This distribution must be calculated. From equation 19,

$$\sigma = \frac{S}{\cos \alpha} = T_l + T_r \qquad (20)$$

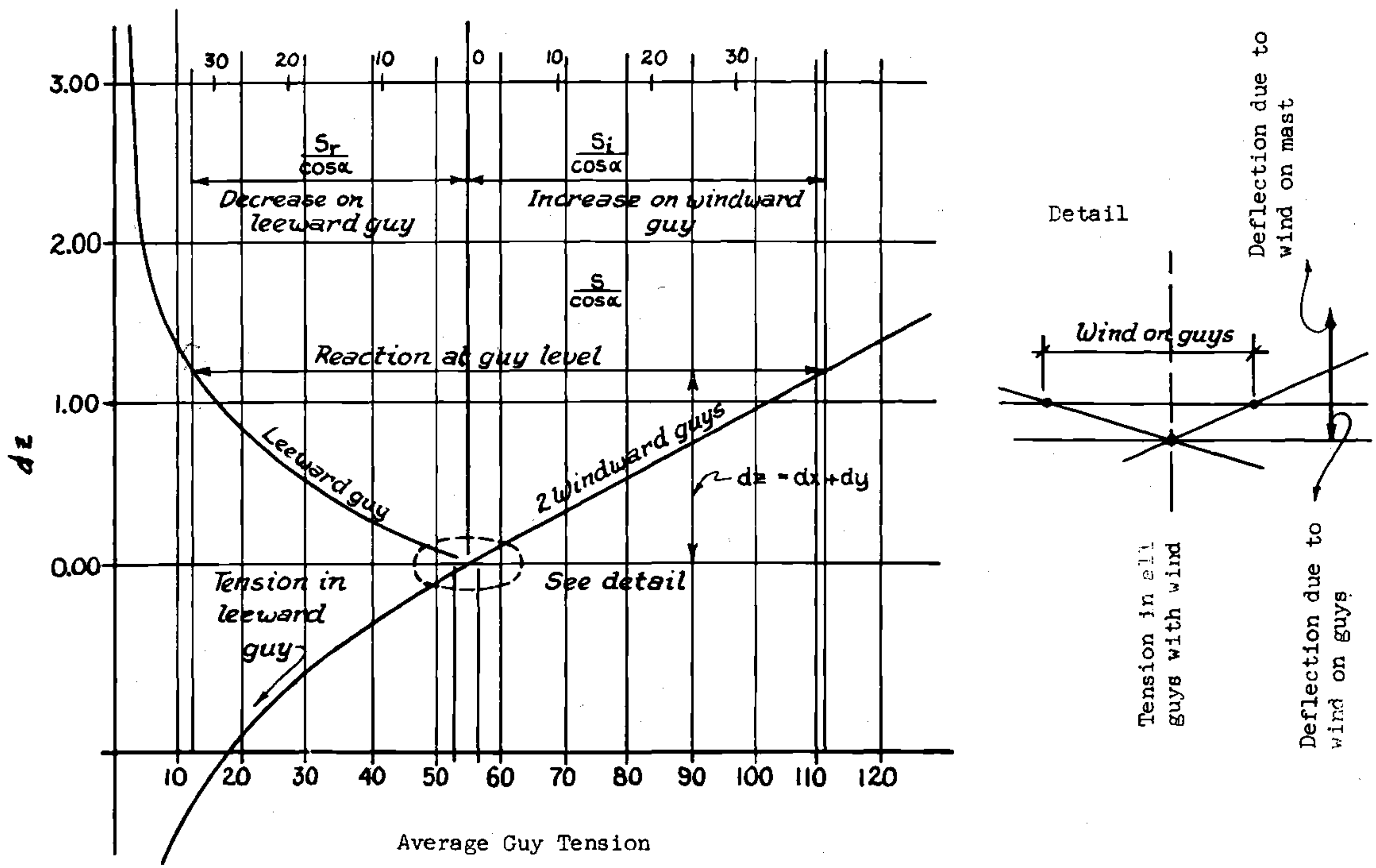


Figure 8 Horizontal Reaction and Displacement at Guy Level

where T_1 is the increase in tension in both of the windward guys, and T_r is the relief in tension in the leeward guy.

To calculate T_1, equations 18 may be solved for

$$G_1 T_i^5 + G_2 T_i^4 + G_3 T_i^3 + G_4 T_i^2 + G_5 T_i + G_6 = 0 \qquad (21)$$

with $\tau_1 = \dfrac{c\,Q_x^2}{6\cos\alpha} \qquad \tau_2 = \dfrac{c}{AE}\sec\alpha \qquad \tau_3 = -\dfrac{c\,Q_x^2}{12\cos\alpha} \qquad (22)$

$$G_1 = 1.5\,\tau_2\,I_0^2$$

$$G_2 = -\tau_1 + \tau_2\frac{I_0^2}{2}\left(12\,I_0 - 7\sigma\right) - \tau_3$$

$$G_3 = -\tau_1\left(4I_0 - 2\sigma\right) + \frac{\tau_2}{2}I_0^2\left(18I_0^2 - 22I_0\sigma + 5\sigma^2\right) + \tau_3\left(2\sigma - 4I_0\right)$$

$$G_4 = -\tau_1\left(5I_0^2 - 6I_0\sigma + \sigma^2\right) + \frac{\tau_2}{2}I_0^2\left(12I_0^3 - 24I_0^2\sigma - \sigma^3\right) + \tau_3\left(-5I_0^2 + 6I_0\sigma - \sigma^2\right)$$

$$G_5 = -2\tau_1 I_0\left(\sigma - I_0\right)^2 + \frac{\tau_2}{2}I_0^2\left(3I_0^4 - 10I_0^3\sigma + 9I_0^2\sigma^2 - 2I_0\sigma^3\right) + \tau_3\left(-2I_0^3 + 6I_0^2\sigma - 2I_0\sigma^2\right)$$

$$G_6 = -\frac{\tau_2}{2}I_0^4\sigma\left(\sigma - I_0\right)^2 + \tau_3 I_0^2\sigma\left(2I_0 - \sigma\right)$$

where I_o is the initial tension with dead load only. However, it is easier to draw the curves $S_i = T_i \cos\alpha$ and $S_r = T_r \cos\alpha$ with the help of Figure 8 and the use of the asymptotes (Figure 9)

$$S_i^{\infty} \longrightarrow \sigma - I_o \cos \alpha$$
$$S_r^{\infty} \longrightarrow I_o \cos \alpha \qquad (23)$$

F. The force K required to produce a displacement μ at the guy level may now be found

$$K = \mu \tan \chi + C_s \qquad (24)$$

as shown on Figure 10. This curve is also drawn with the aid of Figure 8 by correlating the reaction S at the guy level with μ, the displacement at that level.

In Step 3, the mast must be investigated as a continuous beam-column on elastic supports. The general equation for such a beam for the guy level j is

$$S_j = \mu_j K_j - \sum_{K=1}^{n} X_{jK} \mu_K \qquad (25)$$

where S_j is the reaction at level j due to wind pressure, computed with the mast on rigid supports and including wind on guys. μ_j is the displacement at level j, K_j is the spring constant of the guys at level j,

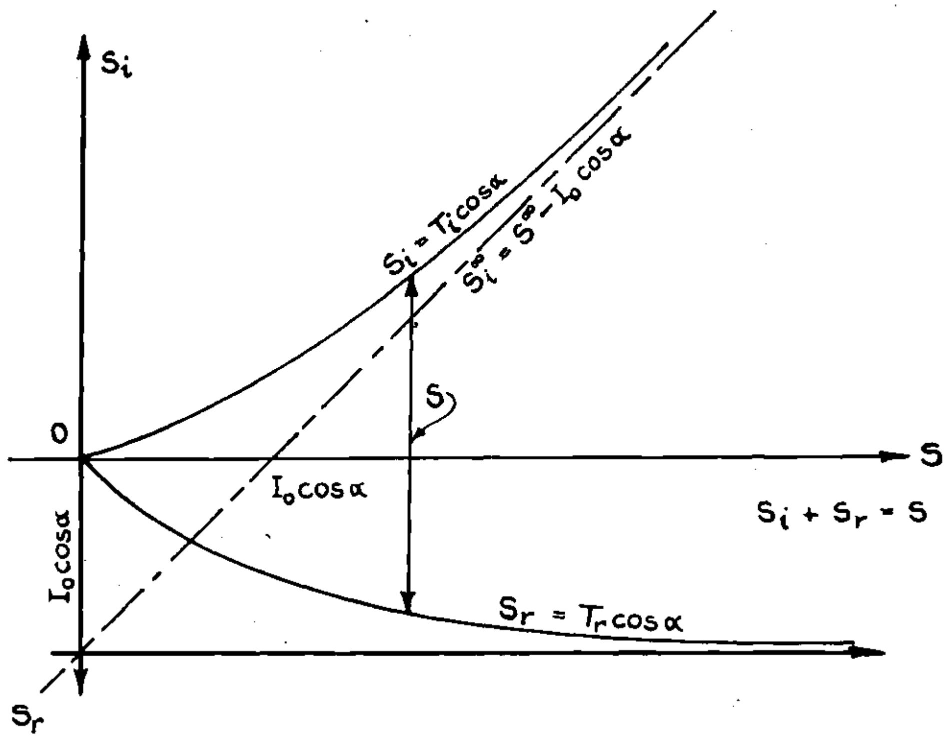


Figure 9 Variation of Stress in Windward and Leeward Guys

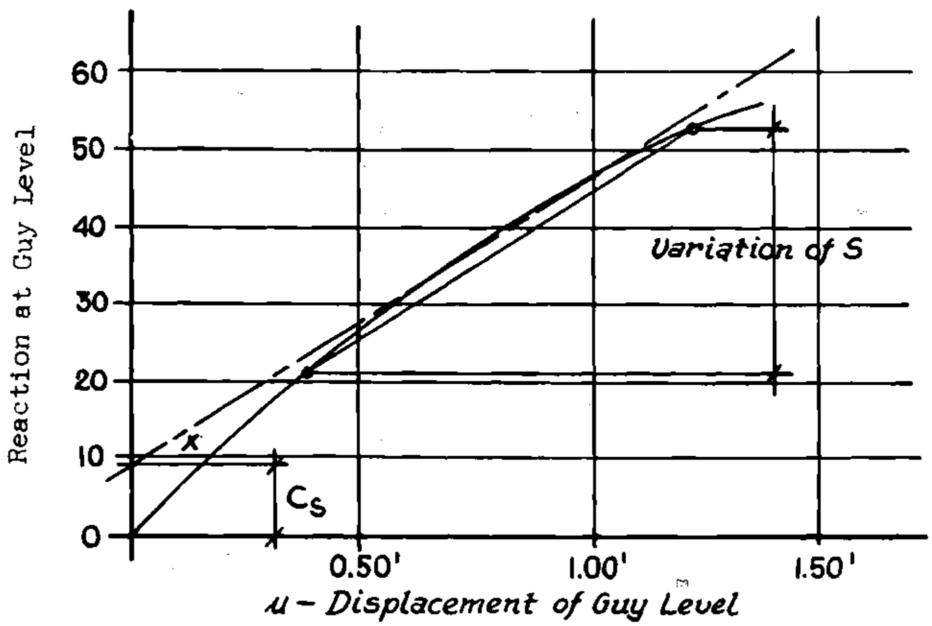


Figure 10 Elastic Spring Constant

and X_{jk} is the reaction at level j due to a unit displacement of the mast at level k, all other supports being held. These coefficients must be determined first by one of the standard procedures for indeterminate structures.

Equations 25 may now be written for each guy level.

$$\mu_j (X_{jj} - K_j) + \sum_{k=2}^{n} \mu_k X_{jk} = -S_j \qquad (26)$$

$$\mu_1 (X_{11} - K_1) + \mu_2 X_{12} + \cdots + \mu_n X_{1n} = -S_1 \qquad (27)$$

$$\mu_1 X_{21} + \mu_2 (X_{22} - K_2) + \cdots + \mu_n X_{2n} = -S_2$$

$$\cdots\cdots\cdots\cdots$$

$$\mu_1 X_{n1} + \mu_2 X_{n2} + \cdots + \mu_n (X_{nn} - K_n) = -S_n$$

The moments induced in the mast by unit deflections are computed when the coefficient X_{jk} is determined. These moments, when multiplied by the final deflections from equations 42, are added to the bending moments in the mast.

In Step 4, the moment induced in the mast by the unequal guy tensions that exist under wind load depends on the change in those guy tensions. For wind normal to one face of the tower (Fig. 11)

$$\Delta V_x = S_i \tan \alpha \qquad (28)$$

and

$$\Delta V_z = S_r \tan \alpha \qquad (29)$$

where Δ V is the change in the vertical component of the guy tension due to wind load. Also,

$$S = S_i + S_r \qquad (30)$$

where S is the applied horizontal reaction obtained when the mast is analyzed as being on rigid supports, plus one half of the wind force on the guys.

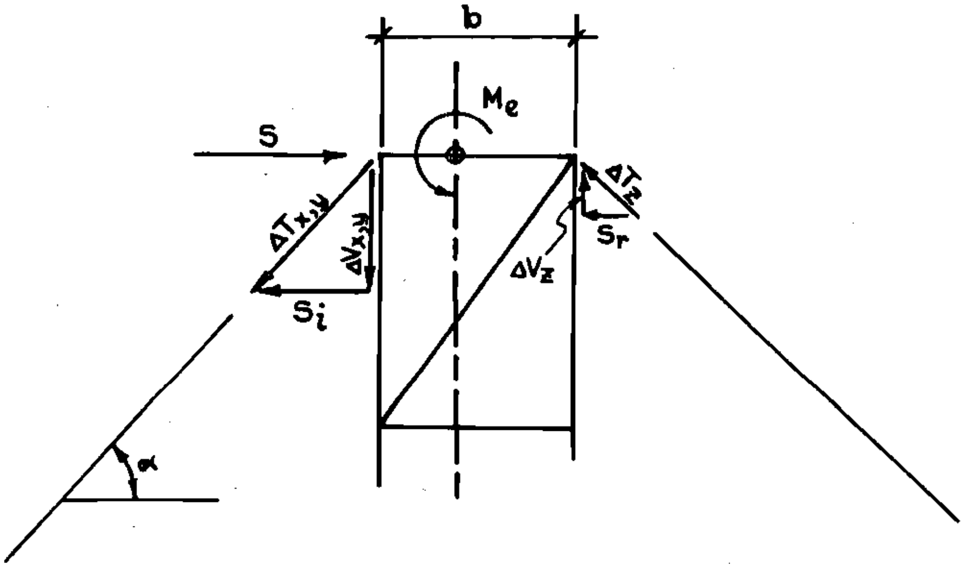


Figure 11 Eccentricity of Vertical Guy Forces

From Figure 11,

$$M_e = \frac{2b}{3} \sum \Delta V = \frac{2b}{3} S \tan \alpha \qquad (31)$$

where M_e is the moment existing if the mast is on rigid supports, and b is the altitude of the triangular cross section of the mast. This may be written as

$$M_e = BS \qquad (32)$$

where $B = \frac{2b}{3} \tan \alpha$, B being a constant for a given guy level. A new set of coefficients Y_{jk} may now be determined by computing the reaction at each guy level j due to a unit force applied at guy level k, and producing a moment $M_e = B$, with $S = 1$. Then

$$S_{fj} = \mu_j K_j = S_{oj} + \sum_{k=1}^{n} X_{jk}\mu_k + \sum_{k=1}^{n} Y_{jk}\mu_k K_k \qquad (33)$$

where S_{fj} is the final reaction at level j, including elastic supports and secondary effects, S_{oj} is the reaction at level j for the mast on rigid supports, μ_j is the final deflection of the support j, K_j is the spring constant at level j, and $Y_{jj}\mu_j K_j$ is the reaction due to the eccentricity of the vertical components of the guy forces at level j.

The moments in the mast due only to the eccentricity of the vertical components of the guy forces are

$$M_{ej} = BS_{fj} = M_{jj_{below}} + M_{jj_{above}} \qquad (34)$$

where M_{ej} is the moment at level j due to eccentricity of the vertical components, $M_{jj_{below}}$ is the moment distributed to level j from below due to the M_{ej} at all levels below j, and $M_{jj_{above}}$ is the moment distributed to level j from above due to the M_{ej} at all levels above j.

Then

$$M_{j_{below}} = M_{jj_{below}} S_{fj} + \sum_{k=1}^{n} M_{jk} S_{fk} \qquad (35)$$

$$M_{j_{above}} = M_{jj_{above}} S_{fj} + \sum_{k=1}^{n} M_{jk} S_{fk} \qquad (36)$$

$M_{j_{below}}$ is the final distributed moment below support j and will be added (or subtracted) from the final moments obtained in the last step of the analysis. $M_{j_{above}}$ represents a similar expression. The M_{jk} are determined when a moment distribution is carried out to find the coefficients

Y_{jk}.

In Step 5, the effects of relative displacement of the guy levels are computed. Because the deflected positions at the guy levels are not collinear, secondary effects due to vertical loads on the distorted mast are introduced. The vertical loads consist primarily of the vertical components of the guy forces, the dead weight of all elements of the tower, and ice load.

Neglecting Vertical Settlement (Figure 12)

$$H\ell = P\mu + \int x \,\Delta P$$

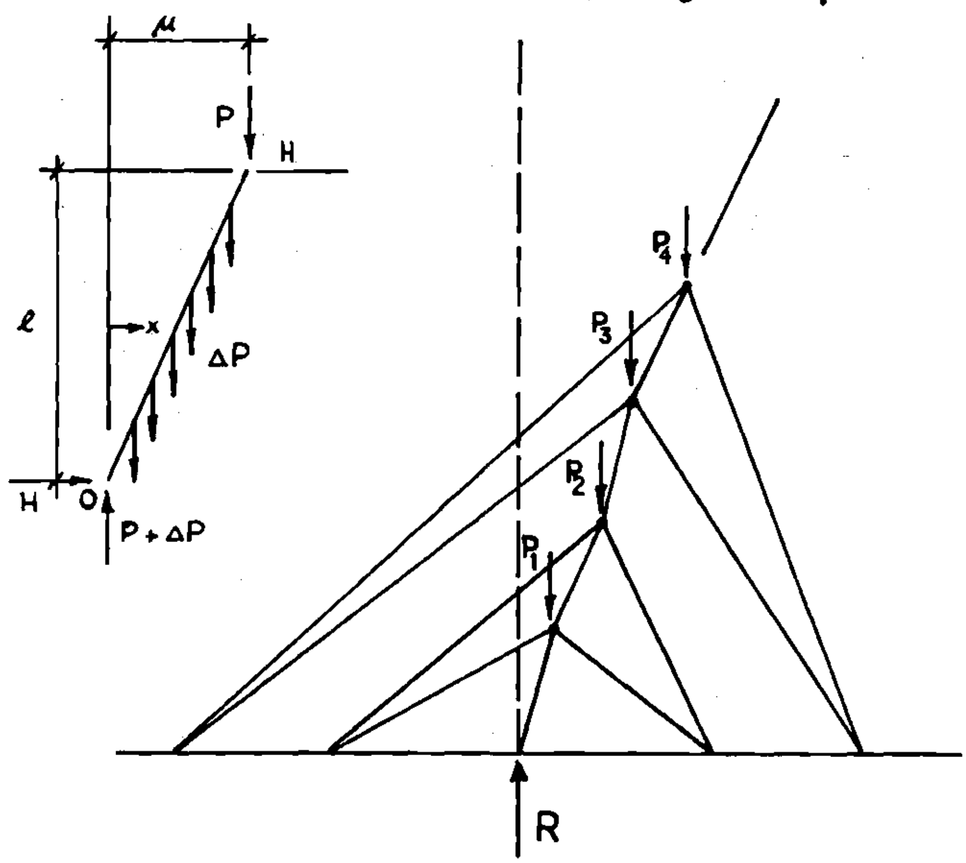


Figure 12 Axial Loads on Distorted Mast

The term $\int \Delta P$ is of small magnitude and can be neglected. The load ΔP is assumed to be concentrated at the guy level.

A unit displacement is assumed at one level at a time with hinges assumed to exist at the guy levels. The axial loads are applied and the reaction at the level of the displacement and the reaction at each adjacent guy level is computed. These may be written as coefficients Z_{jk}, where

$$Z_{j,j+1} = P_{j+1} \frac{1}{\ell_{j,j+1}} \tag{38}$$

$P_j + 1$ is the total vertical load at the level $j+1$. This total load is not constant but varies with the wind loading.

$$P_{j+1} = P_{DL} + P_{IL} + \sum V_{j+1} \tag{39}$$

where

P_{DL} is the total dead load
P_{IL} is the total ice load } above the level $j+1$

V_{j+1} is the total vertical load due to the guy forces at level $j+1$ and above.

$$\sum V_{j+1} = \sum_{j+1}^{n} (2\,\Delta V_x - \Delta V_z) + \sum_{j+1}^{n} 3\,V_0 \tag{40}$$

where V_0 is the vertical component of the initial tension in the guy.

The use of variable coefficients Z_{jk} would make the final solution very complicated. Recognizing that as the wind load increases, the vertical component in the leeward guy becomes very small, it is sufficient to visualize that

$$\sum V \longrightarrow 2\,S \tan\alpha$$

The final equations for the reactions may now be written as follows:

$$\mu_j \left(X_{jj} + Y_{jj} K_j + Z_{jj} - K_j \right) + \sum_{k=1,\, j-1}^{j+1,\, n} \mu_k \left(X_{jk} + Y_{jk} K_k + Z_{jk} \right) = S_{oj}$$

These equations account for elasticity of the supports, eccentricity of the vertical forces at every guy level, and distortion of the mast.

The system of equations may be written as

$$\mu_j \Omega_{jj} + \mu_{j+1} \Omega_{j,j+1} + \ldots + \mu_n \Omega_{jn} = -S_{oj} \qquad (42)$$

$$\mu_j \Omega_{j+1,j} + \mu_{j+1} \Omega_{j+1,j+1} + \ldots + \mu_n \Omega_{j+1,n} = -S_{o,j+1}$$

$$\cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot$$

$$\mu_j \Omega_{nj} + \mu_{j+1} \Omega_{n,j+1} + \ldots + \mu_n \Omega_{nn} = -S_{on}$$

μ_j is the final deflection of the support j and Ω_{jk} is the force perpendicular to the mast at guy level j for a unit displacement at level k including all effects. The final deflections μ_j are found from the system of Equations (42), and the final reactions are

$$S_{fj} = K_j \mu_j \qquad (43)$$

The final moments are computed by adding the bending moments found from the analysis of the mast on rigid supports to those due to the elastic deflection at the supports, and those due to the eccentricity of the vertical components of the guy forces.

In Step 6, torsional effects are computed. If torsional effects exist, reference is made to Cohen & Perrin for the method of analysis of these effects on the guy forces and the lacing of the mast (5). If no unbalanced areas exist on the mast, torsion does not exist. Since the purpose of the present work is to analyze symmetrical multi-level guyed towers used for television type antennae, it is assumed that torsion is not a factor, and no further explanation will be presented here.

The above presentation concludes the discussion of the general approach to tower analysis.

<u>Fiesenheiser's Method For Tower Design (1).</u> - - Because of the complexity of the general approach to tower analysis, including the setting up and solving of multiple simultaneous equations, and the undesirability of having the mast distorted into undulations which result in unnecessarily high stresses in the mast because of its non-linearity, Fiesenheiser has simplified the analysis by putting a rigid requirement on the design (1).

This requirement calls for adjusting the spring constants of the guys so that a straight line drawn from the tower base to the top support point will pass through all support points. The mast is then designed as a continuous beam-column on unyielding supports. The spring constants are adjusted, in effect, by selecting the areas and length of the guys of each set so that they will provide the correct amount of resistance. The analysis is not only simpler and much easier to perform, but also the multi-level guyed tower is probably safer than if relative support displacements existed, since there is less danger of the mast buckling. For the above reasons, Fiesenheiser's approach to tower design has proved to be a popular and practical one.

The statements of the general principles of tower design made previously apply to all methods of tower design; since Fiesenheiser's simplification of the problem is concerned mainly with design of the guys, this subject will be explored in detail.

The forces in the guys may be taken as directly proportional to the weight w per unit length L (Figure 13).

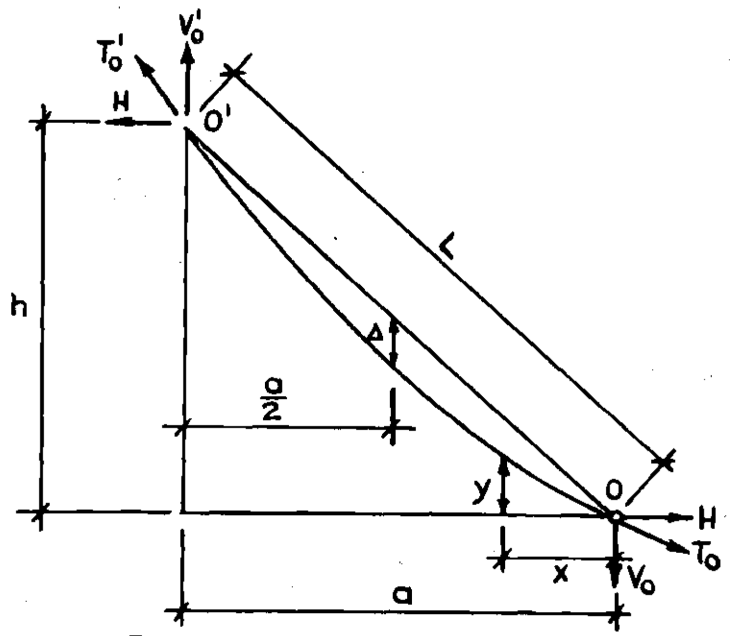


Figure 13 A Single Inclined Guy

By considering the equilibrium of forces on an increment of guy length, the following equation of the elastic curve may be written

$$y = \frac{wL}{2aH} x^2 + \left(\frac{h}{a} - \frac{wL}{2H}\right) x \qquad (44)$$

By substituting a/2 for x, the following equation results

$$y = \frac{h}{2} - \frac{\omega L a}{8H} \tag{45}$$

but $\frac{\omega L a}{8H}$ must equal Δ, therefore,

$$H = \frac{\omega L a}{8\Delta} \tag{46}$$

Applying the condition of static equilibrium to the element shown in Figure 13, we obtain

$$V_o' = \frac{h}{a} H + \frac{\omega L}{2} \tag{47}$$

As a result, the guy force at the upper end of the element is as follows:

$$T_o' = \sqrt{H^2 + V_o'^2} \tag{48}$$

The vertical component of the guy force at ground level is

$$V_o = \frac{h}{a} H - \frac{\omega L}{2} \tag{49}$$

and the total guy force at ground level is

$$T_o = \sqrt{H^2 + V_o^2} \tag{50}$$

A sufficiently exact formula for the guy length L_G may be derived by referencing curve coordinates to the sloping line oo' in Figure 13. The resulting equation is

$$L_G = 2\int_0^{\frac{L}{2}} \sqrt{1 + \left(\frac{8a\Delta x'}{L^3}\right)^2} \, dx \tag{51}$$

which may be expanded into a binomial series. The series may be written as follows, using the first two terms of the series,

$$L_G = L + \frac{8a^2\Delta^2}{3L^3} \tag{52}$$

or

$$L_G = L + n \tag{52a}$$

where

$$n = \frac{8a^2\Delta^2}{3L^3} \tag{53}$$

Solving for the center-line sag, we obtain

$$\Delta = 0.612\,\frac{L^{3/2}}{a}\sqrt{n} \tag{54}$$

From equation 54 it may be observed that the sag is proportional to the square root of n, the difference between the actual curve length and the chord length L.

Under the action of the wind, the mast moves with the wind, causing the guys on the windward side to carry more load. At the same time, the tension is relaxed somewhat in the leeward guys. In the case of the leeward guys large changes in sag accompany relatively small mast movements. It is a necessary prerequisite to further analysis of the guy system to be able to calculate the relaxation of tension in the leeward guy.

The initial component H_1 of the tension in the leeward guy is shown in Figure 14.

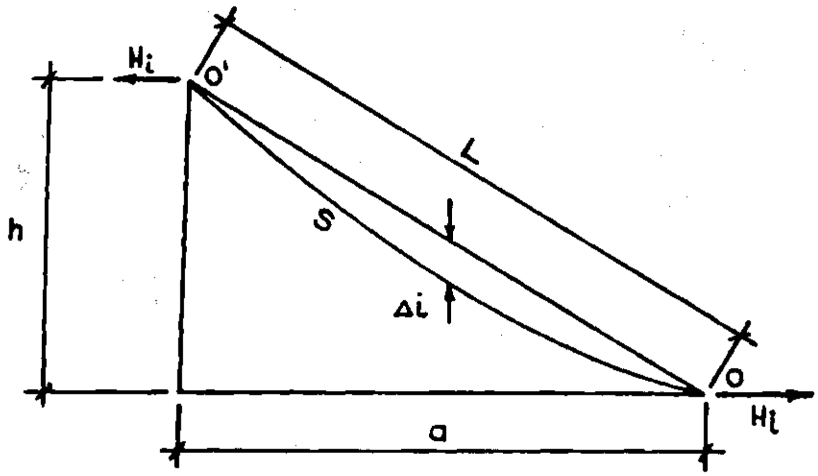


Figure 14 Initial Horizontal Component in a Leeward Guy

For a known initial sag Δi , H_i may be calculated from Equation 46

$$H_i = \frac{wLa}{8\Delta_i}$$

Referring to Figure 15, distances a and L are shortened to $a' = a - d_c$ and L', respectively. The original curve length S remains approximately the same. From Equation 52a

$$L_G = L' + n'$$

which may be solved for n'.

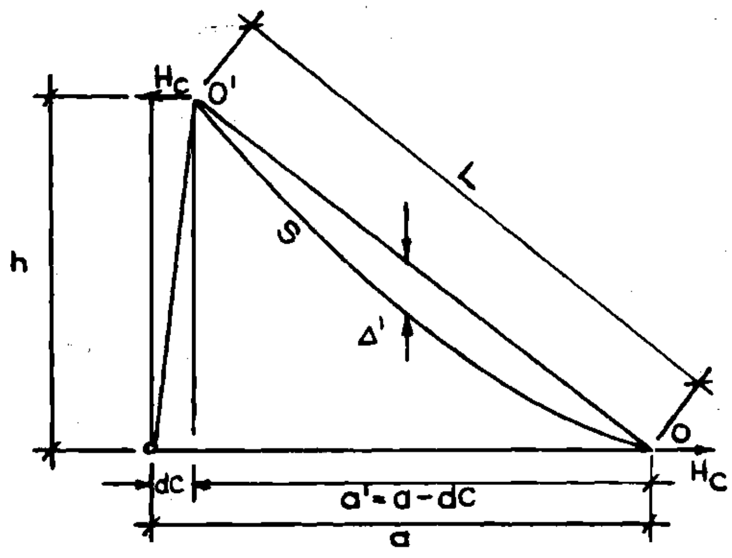


Figure 15 Final Horizontal Component in a Leeward Guy

By the use of Equation 54, the new sag Δ' may be computed.

$$\Delta' = 0.612 \left(\frac{L'}{a}\right)^{3/2} \sqrt{n'}$$

and

$$H_c = \frac{\omega L' a'}{8 \Delta'} \tag{55}$$

However, the Equation for Δ' is more complex than necessary; a sufficiently exact equation, derived from Equation 54, is

$$\Delta = K \Delta_i$$

where

$$K = \sqrt{1 + \frac{a\, d_c}{n L}} \tag{56}$$

Then

$$H_c = \frac{\omega L a}{8 K \Delta_i} \tag{57}$$

Equations 44 through 57 pertain to the action of single guys. It is necessary to study the combined action of all guy forces in resisting the force of the wind at a mast support point. The mast movement may then be calculated, the maximum tensions in the guys determined, and the guys designed.

Before the wind acts on the mast, the horizontal components of initial tension in the guys at any given level are equal. When a wind force F is added, the initial forces are changed (Figure 16). The horizontal component of the force in guy A is increased from H_i to a new value H_A and that of guy B to H_B. In guy C the force is reduced from

H_i to H_C. From the geometry of the force polygon, H_A and H_B are determined in terms of H_C. H_C can be found from Equation 57 after the mast movement d_c is calculated.

To design a guy, one must know its maximum load. Selecting guy A for study, the guy force

$$H_A = H_C + \frac{F \sin \varphi}{\sqrt{3}}$$

will be a maximum when $\sin \varphi$ is maximum $(\varphi = 90^\circ)$ as shown in Figure 16.

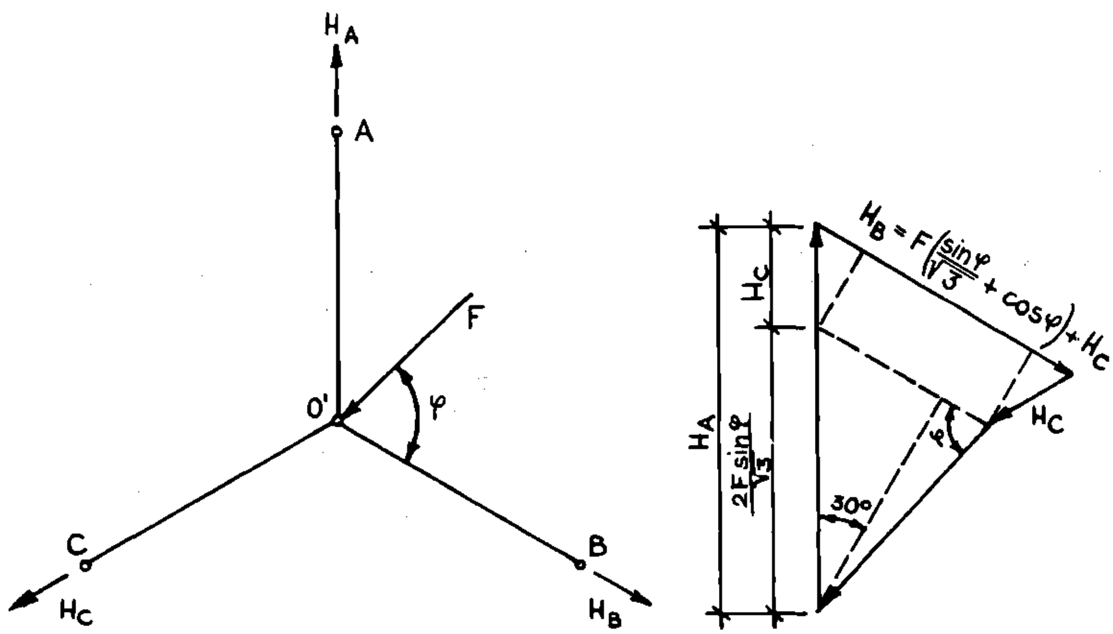


Figure 16 Guy Forces With Wind on the Mast

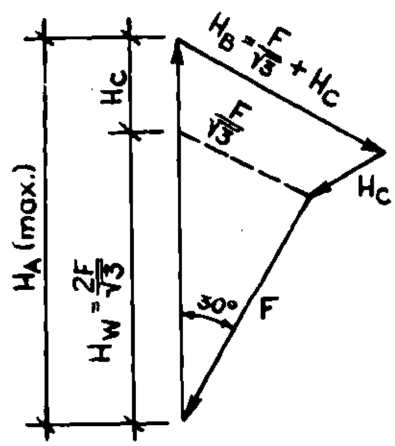


Figure 17 Guy Forces With Wind Normal to the Plane of One Guy

The condition when $\varphi = 90^\circ$ is shown in Figure 17. A study of the force polygon in Figure 17 shows the effects of force F on guys A and B. The effect on guy B is one-half the effect on guy A; the component of mast movement in the direction of B will be one-half that in the direction of A. Figure 18 illustrates these movements; inspection of the figure also reveals that when $\varphi = 90^\circ$, the maximum possible movement of mast point o' results.

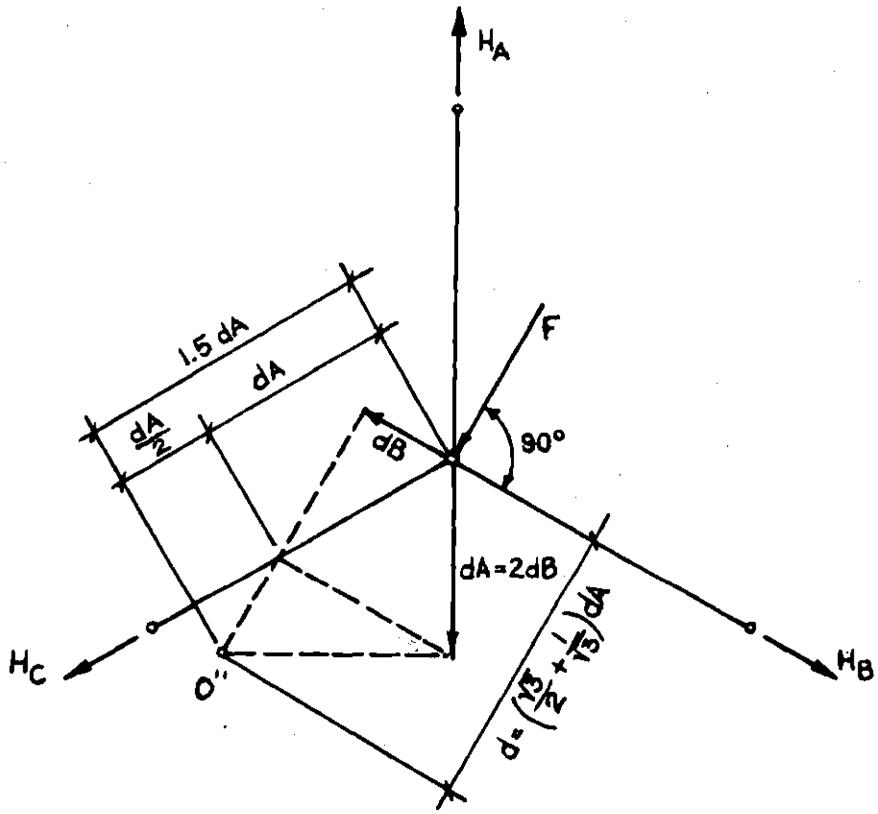


Figure 18 Mast Movement for Maximum Guy Force

Point o'' is the final position of the mast point o'. From the geometry of the figure, $d_c = 1.5\ d_A$. Movement d represents the mast movement in the direction of the wind.

In Figure 17, it may be seen that the horizontal component of the elongation of guy A is

$$d_A = \frac{H_w L}{AE} = \frac{2FL}{\sqrt{3}AE} \tag{58}$$

In Figure 18,

$$d = \frac{5FL}{3AE} \tag{59}$$

In order to calculate H_c it is first necessary to find d_c.

$$d_c = \frac{3}{2} d_A = 1.04 \ d \tag{60}$$

The wind force F includes the horizontal wind reaction R on the mast and the reaction induced by wind on the guys. The value R is determined by analyzing the mast as a beam-column on rigid supports. If p is the wind force per unit of guy length, the reaction from the wind on the guys can be found by multiplying p times one-half of the total length of all guys projected onto a vertical plane perpendicular to the wind direction .

$$F = R + pL \tag{61}$$

Therefore,

$$d = 5 (R + pL) \frac{L}{3AE} \tag{62}$$

Letting $Q = \frac{3AEd}{5}$, and using the quadratic theorem, the required length L for a mast movement d is, from Equation 62

$$L = \sqrt{\left(\frac{R}{2p}\right)^2 + \frac{Q}{p}} - \frac{R}{2p} \tag{63}$$

The area A must be adequate to provide for the maximum force; the variables A and L are adjusted to develop the required force and mast movement. The mast may then be designed as a beam-column on rigid supports.

To design the guys, assume straight line mast deflection with no relative displacement of the supports from the straight line. The mast reactions R can then be calculated. Starting with the top set of guys, the movement d at this location is calculated using Equation 59; this involves choosing a trial size for the top set of guys which must be checked later against the allowable load conditions. The d values at the other support points are then found by proportion. With the required mast movement known, Equation 63 is used to proportion the guys.

In the design of the mast, the mast must be checked against two criteria. The individual leg members themselves act as columns between their points of lateral support, and the mast itself acts as a column between guy supports.

The loads may be calculated by isolating the individual spans as free-bodies and calculating the end shears and maximum moments. Tower design specifications require the application of an interaction type formula to the design of the mast of the form

$$\frac{f_a}{F_a} + \frac{f_b}{F_b} < 1 \tag{64}$$

The use of such an interaction formula is a simplification which is conservative; the values of maximum stress may be considerably different than the equation would assume, especially in regard to a space truss composed of members of circular cross-section. This latter subject deserves further study and experiment.

As a final generalization, the legs of the mast carry the bending and the direct stresses; the lacing between the legs carries the shear.

The tower design is virtually complete with the design of the guy anchors and the mast footing. Design of these items, and design of the connections follows standard practise.

In summary, the problem of tower design and analysis may be approached in a very general way, as per Cohen & Perrin (5), or restrictions may be imposed upon the design which will result in considerable simplification of the analytical procedures, as per Fiesenheiser (1). Both approaches are feasible, both are equally exact, both are acceptable.

CHAPTER III

PROCEDURE FOR THE COMPUTER STUDY

When the designer begins the design of a guyed aerial tower which must satisfy certain requirements as to height, antenna load, wind load, and ice load, he must assume values for certain variable factors such as the anchor spacing, vertical spacing of the points of guy attachment to the mast, and leg spacing.

There are few guides available in current literature which would indicate optimum values for such variable factors. Study of reports on other towers which have been built in the past does not answer the question as to whether these towers as built were the most economical choices which could have been used at their field locations.

As a practical measure, several configurations are chosen, designs made for each, and the choice of a final design made on the basis of study of these few trials. The results of the computer study described herein, which includes the design of 354 separate towers, presents sufficient data for the analysis of the effects of variations in anchor spacing, leg spacing, and guy attachment spacing on the mast weight of the type of guyed aerial tower assumed in this study. In order to cover a considerable range of mast heights, the decision was made to study 144 towers 500 feet high, 105 towers that were 700 feet high, and 105 towers that were 900 feet high. In the case of the 500 foot towers, the number 144 was reached by including all combinations composed of three different leg spacings, six arrangements of the points of attachment of the guys to the mast, and eight different arrangements of anchor locations. On the basis of the information found in this portion of the study, the number of guy arrangements was reduced to five, and the anchor arrangements to seven, for the remainder of the study.

It was assumed that each tower would have five sets of guys. Individual sets of guys were spaced at 120° allowing for three guylines at each of the five levels. Each mast was designed to support a six-bay antenna under the action of a 40 pound per square foot wind load. The design weight of the antenna was 18,000 pounds, the design bending moment at the base of the antenna (the top of the mast) was 274,800 pound-feet, and the design shear at the base of the antenna was 6,550 pounds.

The assumption was made that on spans AB and BC (Figure 1), the mast would carry a horizontal wind pressure of 50 pounds per square foot on flat surfaces, with allowance for shape factors. For spans CD and DE, a 45 pound per square foot wind load was used, and for span EF, the wind load was reduced to 40 pounds per square foot. The wind pressure was applied to one and one-half times the normal projected area of all members in one face of the mast, which was assumed to be triangular in cross-section (Figure 2), with steel pipe used for all structural members of the mast. Additional dead load allowance was made for supplementary material such as ladder, bolts, coaxial cables, and warning lights.

It was further assumed that the top three sets of guys would be connected to the outer anchors, and the bottom two sets (Figure 1), connected to the inner anchor.

The design procedure, using the Fiesenheiser approach as explained in Chapter II, was programmed for use on the IBM 650 electronic computer. The computer was instructed to substitute each of the 354 configurations into the program; the output of the program included the necessary data for the design of the mast and the guylines, including the selection of the necessary sizes of guys and structural members in the mast.

In order to make the latter step possible, data on commercial sizes of wire rope and steel pipe was placed in the basic data, and the computer was instructed to make the optimum (least weight) selection of material. The output from the computer included the numerical output of each equation used in the design.

The design procedure is explained in detail in Appendix C in the form of an example problem.

CHAPTER IV

DISCUSSION OF RESULTS

The result of the computer program was a considerable body of data listing the numerical output of the design equations. Among the quantities to be found in the computer output for a single tower are such values as the maximum guy forces, the total vertical load in the mast at each guy level, the guy sizes, and the leg sizes. A very small part of the output has been abstracted and included in Tables 1 through 22.

In order to present the results graphically, a set of curves is drawn by comparing mast weight with guy arrangement and leg spacing for each of the anchor arrangements. This results in a set of figures with three curves on each figure; each of the curves represents one possible spacing of the legs. Horizontal coordinates represent guy attachment spacing; ordinates represent mast weight. Inspection of each figure shows not only the arrangement which results in the least mast weight for those combinations shown by the figure, but also shows the trend in the mast weight as the guy attachment spacing and the leg spacing is varied. Since there is one figure for each anchor arrangement, the comparison of mast weight with anchor location may be made by checking all of the figures for a given mast height.

Finally, a set of empirical equations (Chapter V) was formulated by comparing the trends in the mast weight with tower height, as influenced by variations in each of the parameters. These equations may be used to obtain preliminary trial values for leg spacing, guy attachment spacing, and anchor spacing; since the tower heights in the study varied between 500 feet and 900 feet, the equations are recommended for use in guyed aerial tower designs where the tower heights vary between those levels.

The empirical equations do not give exact values for the parameters suitable for all tower designs. The following assumptions were made in this study: that the mast cross-section was triangular, that the structural members of the mast were made from steel pipe, that the wind load on the mast followed a definite pattern varying from 50 pounds per square foot at the top of the mast to 40 pounds per square foot at the bottom of the mast, that five guy levels were used with three guys spaced 120° apart at each level, and that each mast carried a standard six-bay television antenna cantilevered 103 feet above the top of the mast. In addition to the above, it should be kept in mind that the over-all economy of a guyed aerial tower installation depends on factors which were not included in this investigation. Some of these factors are the land area required, the quantity of concrete in the footing and anchors, the amount of excavation for footing and anchors, variation in the number of guy levels, the problems involved in handling and shipping large, heavy mast sections, and the effect of the design on the field problem of the tower erection.

The equations given in Chapter V may be used as a guide so that the number of design trials may be reduced to a minimum by the selection of values for the leg spacing, anchor spacing, and guy attachment spacing which are reasonably near the final design configuration.

With respect to future research, experimental verification is needed as to whether the predicted theoretical values of unit stress in the legs of the mast, and the maximum forces in the guys, agree with the actual values that exist under field conditions.

CHAPTER V

CONCLUSIONS

The following empirical equations may be used in guyed aerial tower design as an aid in choosing preliminary trial values for anchor spacing, leg spacing, guy attachment spacing and for estimating the mast weight.

1. For determination of the anchor location (Figures 19 & 20)

$$a = 0.8\,h$$

where a = the distance in feet from the base of the mast to the anchor.

h = the height in feet from the base of the mast to the point of attachment on the mast of the top set of guys connected to that anchor.

2. For determination of the guy spacing no equation if necessary. It is recommended that the points of guy level attachment to the mast be spaced equally along the length of the mast.

3. For determination of the leg spacing (Figure 21)

$$D = H/200 + 2.5 \qquad 500 < H < 900$$

where D = the leg spacing in feet

H = the total mast height in feet

4. For determination of the estimated mast weight (Figure 22)

$$W = 0.2\,H - 70 \qquad 500 < H < 900$$

where W = the estimated mast weight in kips

H = the total mast height in feet

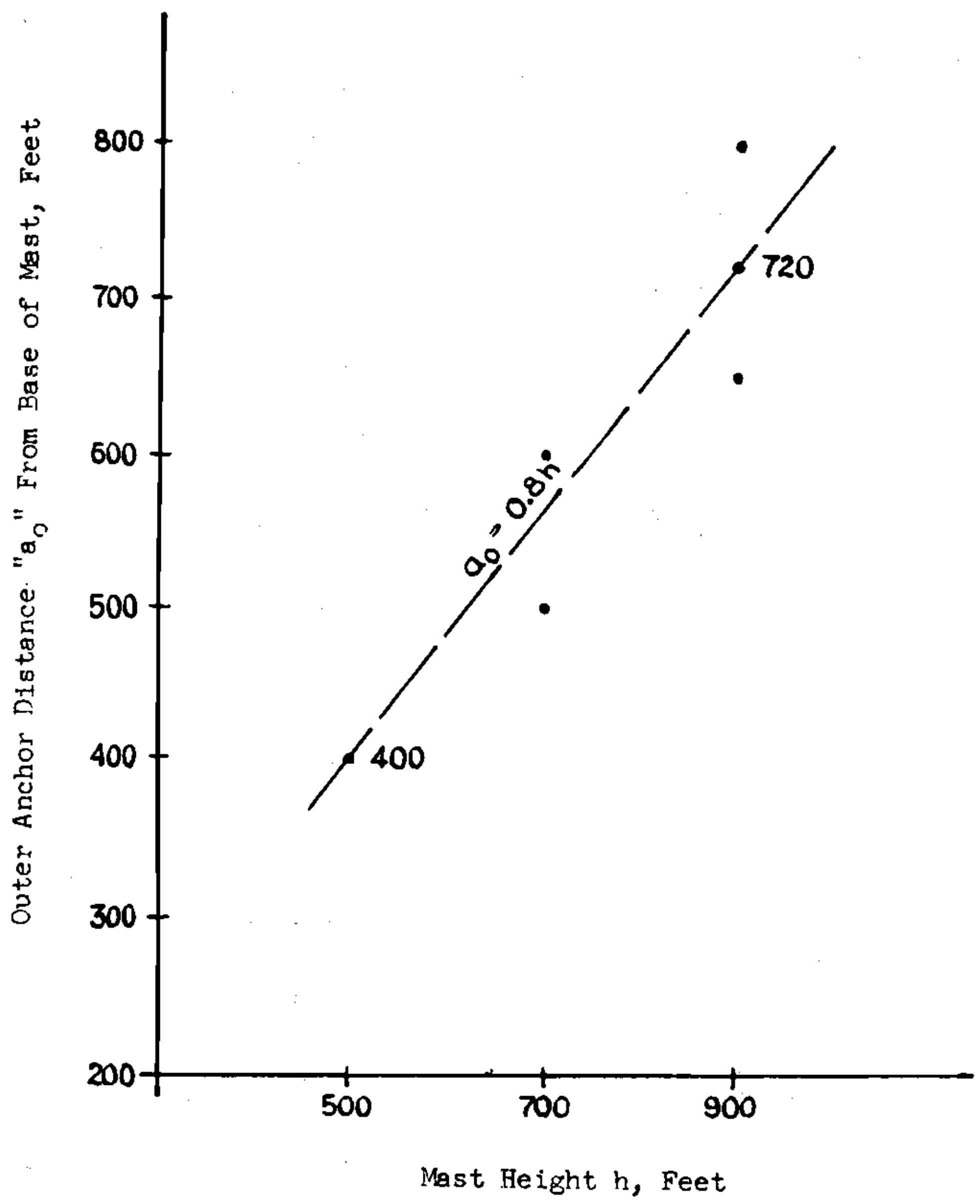


Figure 19 Mast Height Compared With Outer Distance "a_o" for Guy Arrangement C and Masts of Least Weight

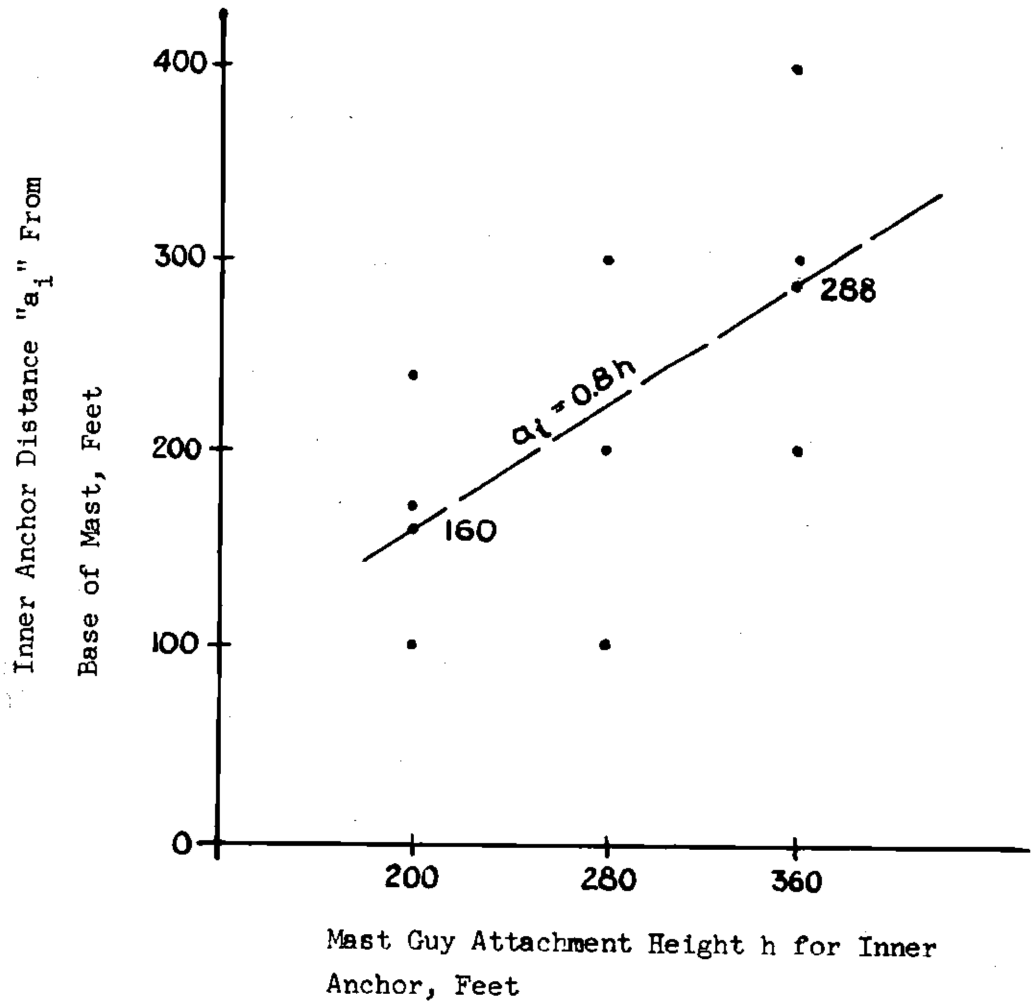


Figure 20 Inner Anchor Distance "a_i" for Guy Arrangement C and Masts of Least Weight

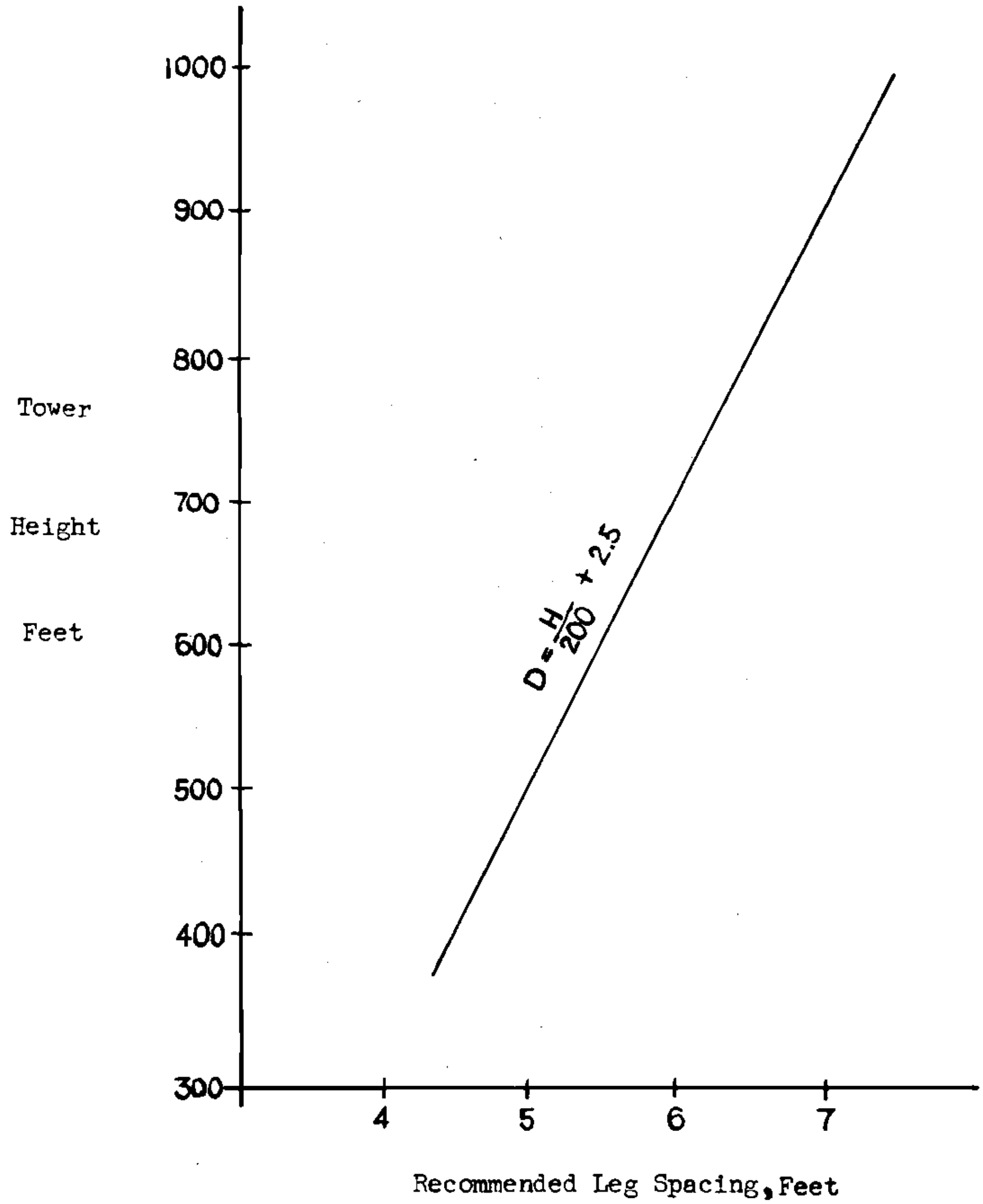


Figure 21 Leg Spacing Compared With Tower Height

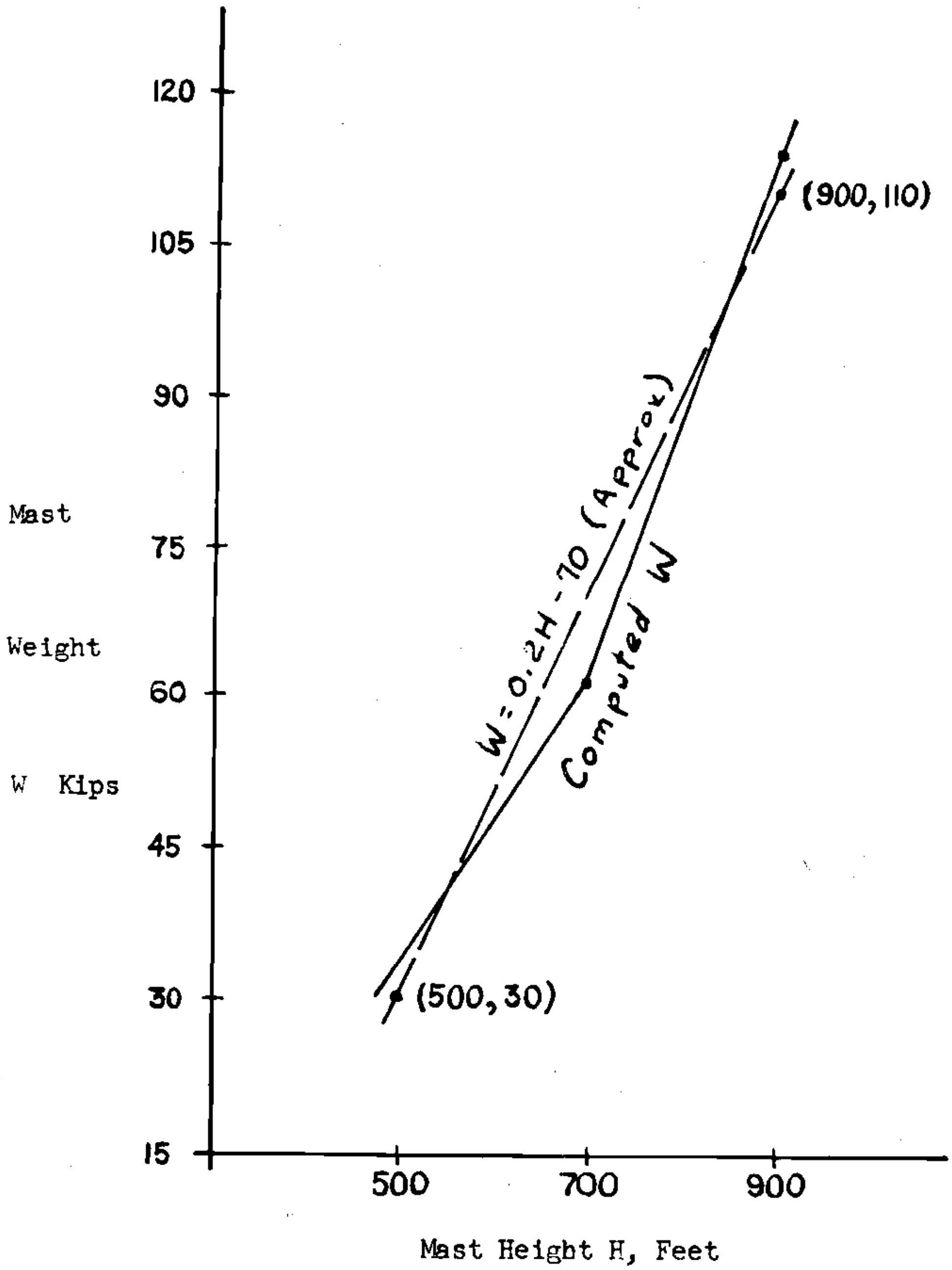
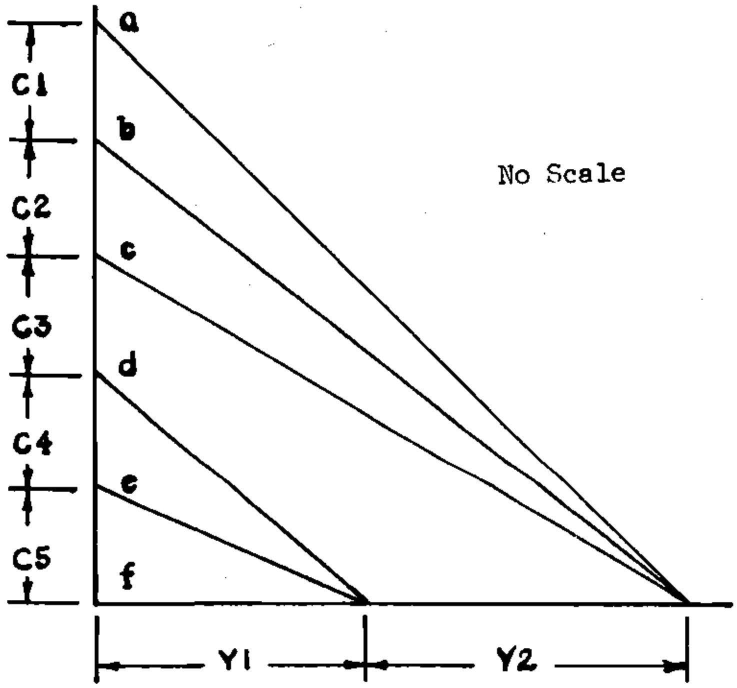


Figure 22 Least Mast Weight Compared With Mast Height

APPENDIX A

GRAPHIC REPRESENTATION OF OUTPUT DATA



Guy Arrangements

	A	B	C	D	E	F
C1	130	120	100	120	80	60
C2	110	110	100	80	100	100
C3	100	90	100	80	100	100
C4	80	90	100	110	110	120
C5	80	90	100	110	110	120

Figure 23 Guy and Anchor Arrangements for 500 Foot Tower

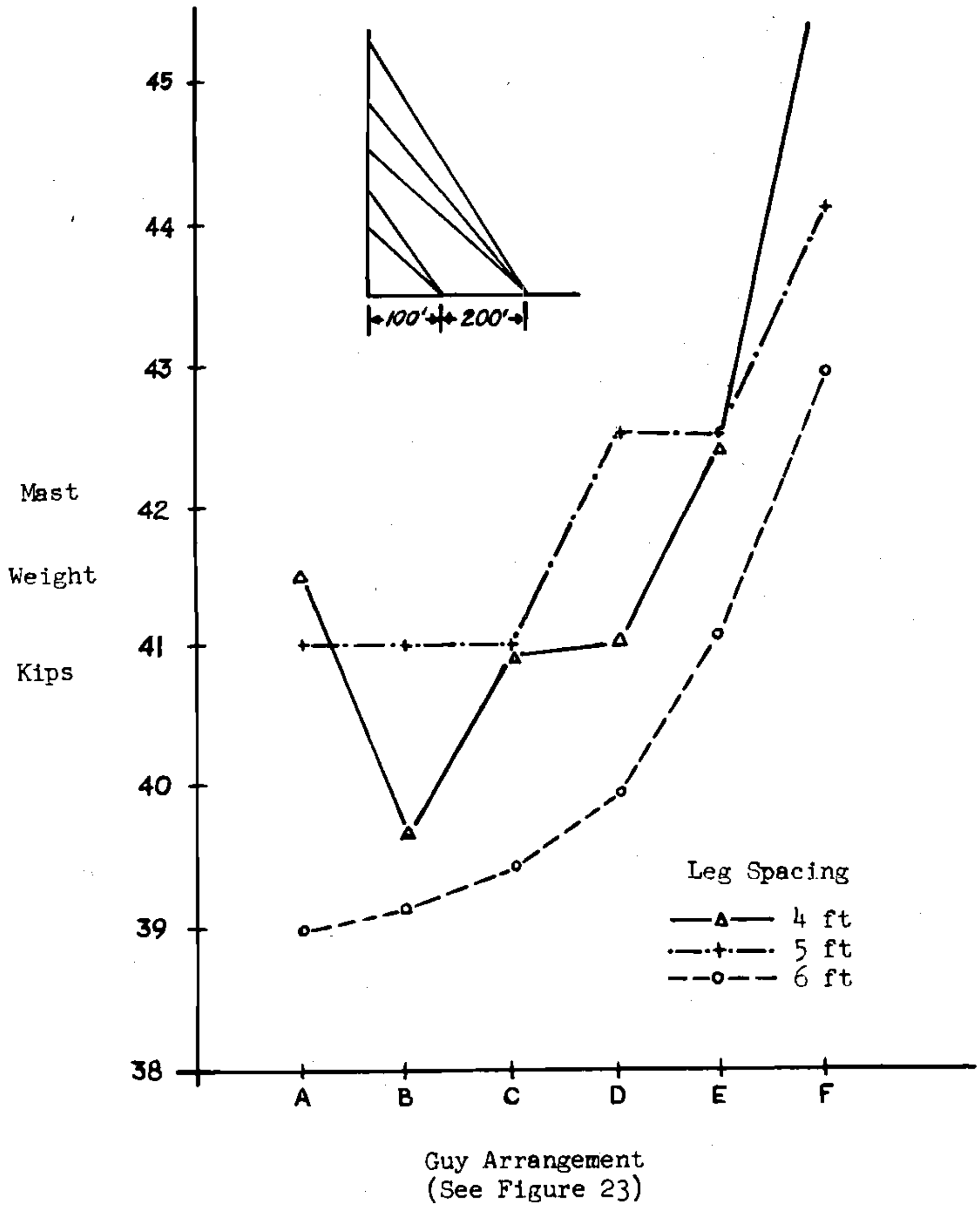


Figure 24 Guy Arrangement, Anchor Spacing, and Leg Spacing Compared to Mast Weight, 500 Foot Tower

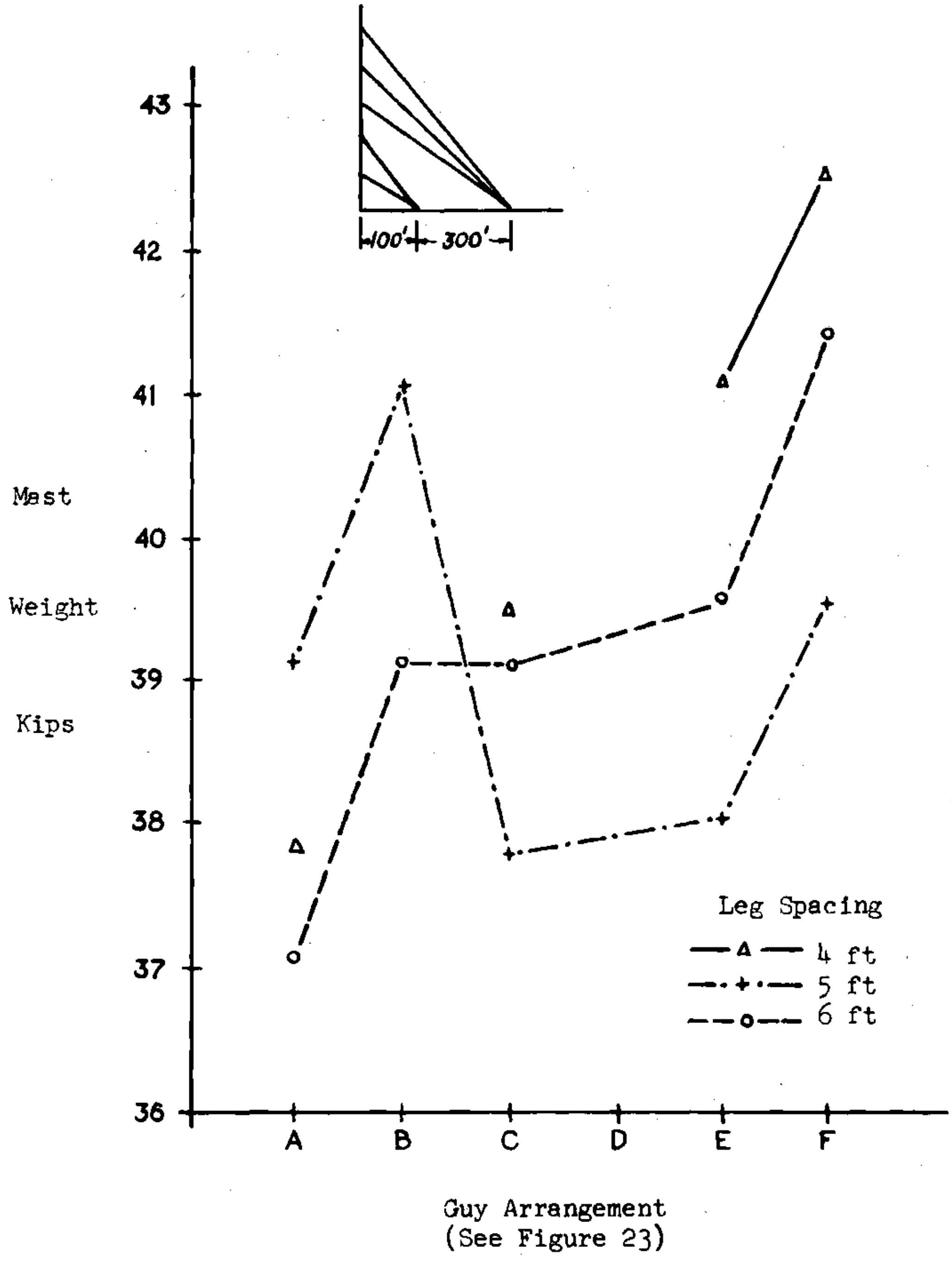


Figure 25 Guy Arrangement, Anchor Spacing, and Leg Spacing Compared to Mast Weight, 500 Foot Tower

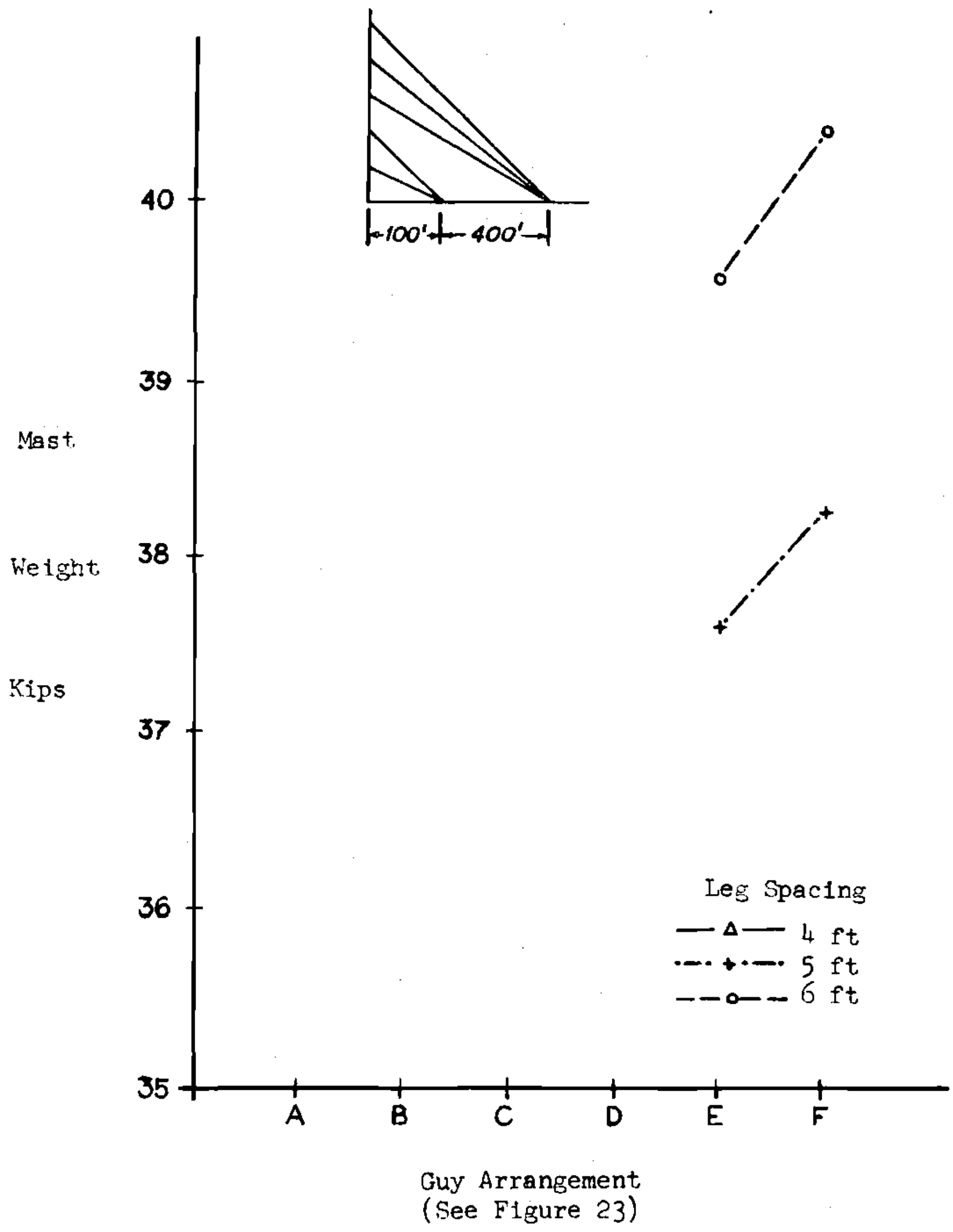


Figure 26 Guy Arrangement, Anchor Spacing, and Leg Spacing Compared to Mast Weight, 500 Foot Tower

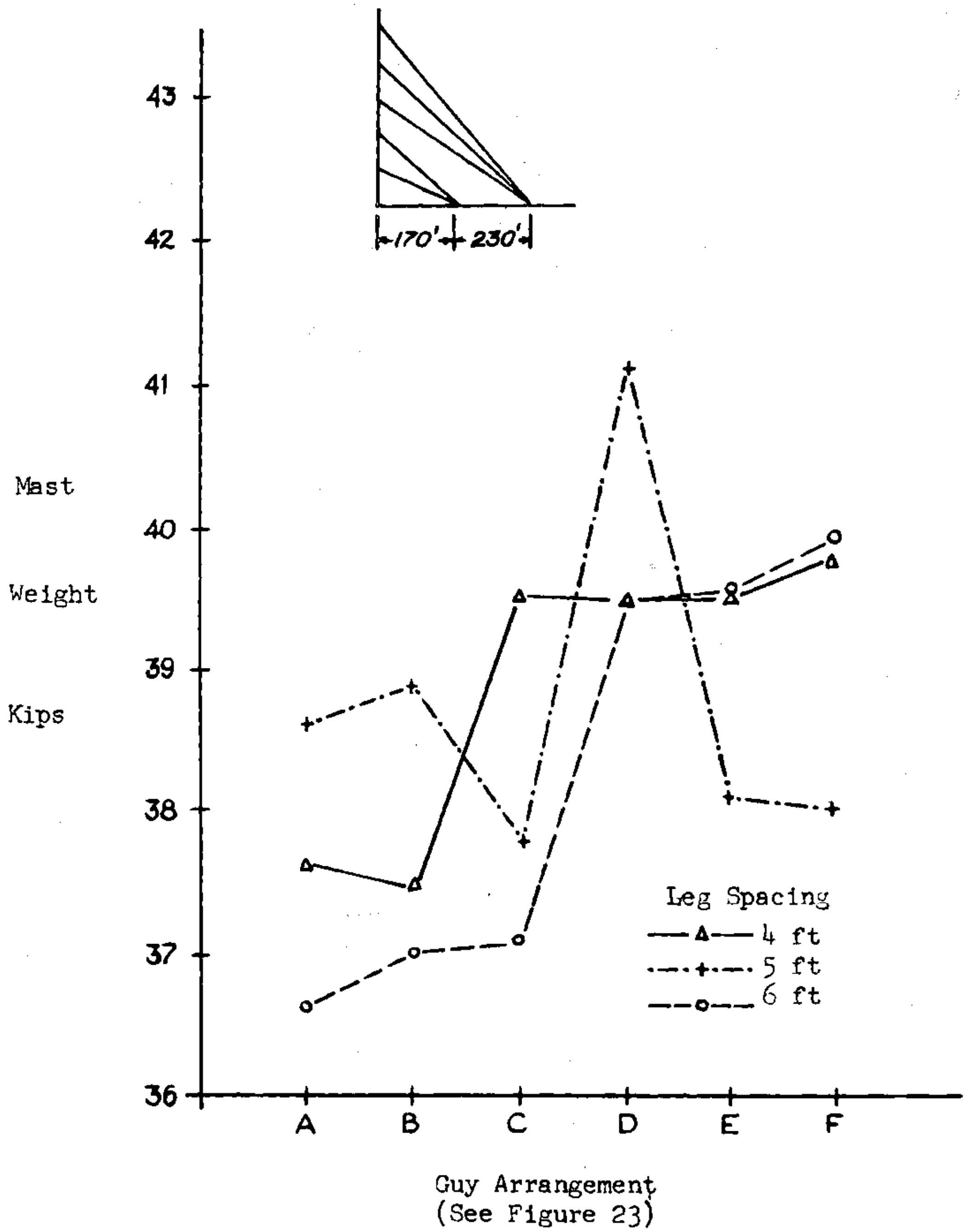


Figure 27 Guy Arrangement, Anchor Spacing, and Leg Spacing Compared to Mast Weight, 500 Foot Tower

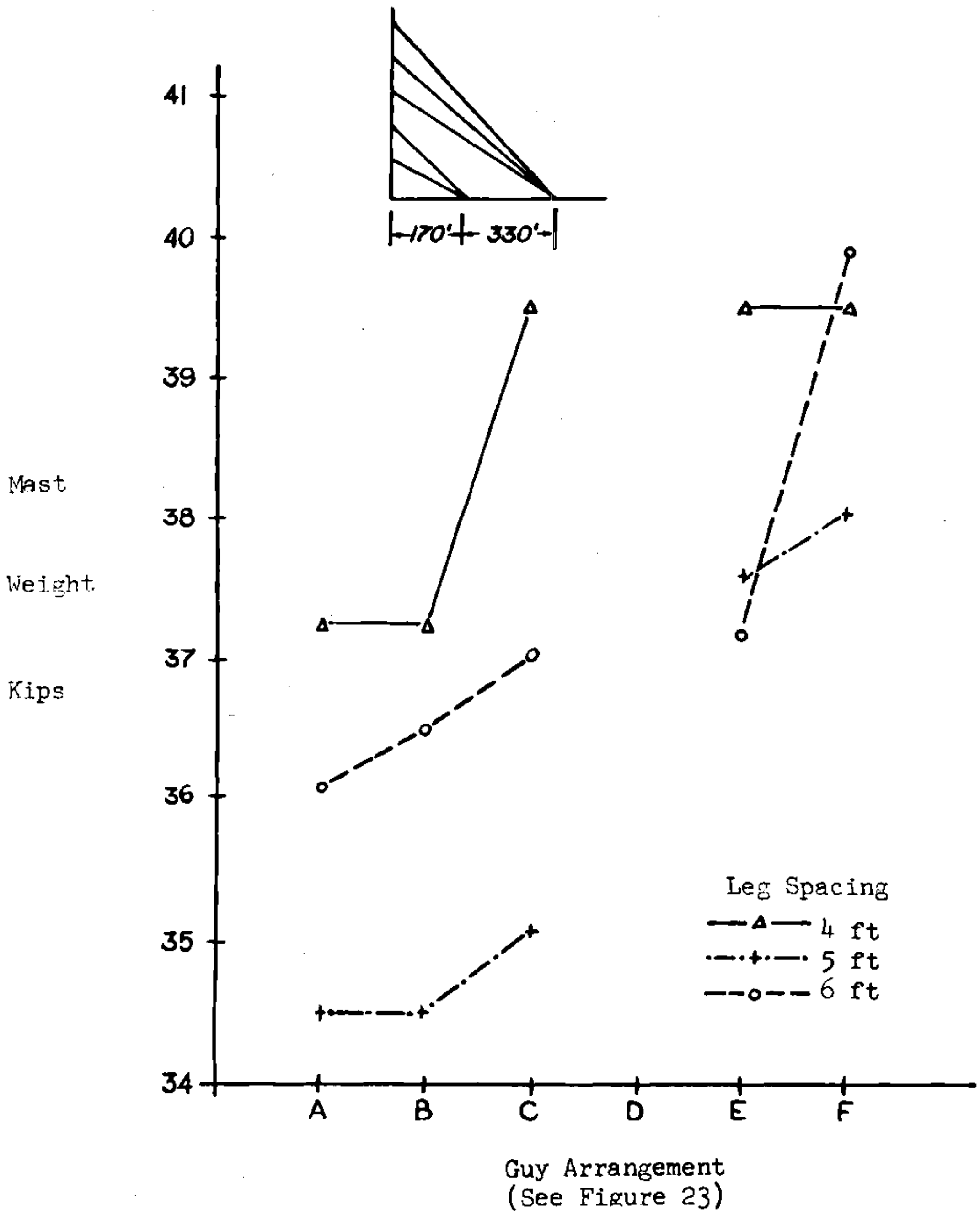


Figure 28 Guy Arrangement, Anchor Spacing, and Leg Spacing Compared to Mast Weight, 500 Foot Tower

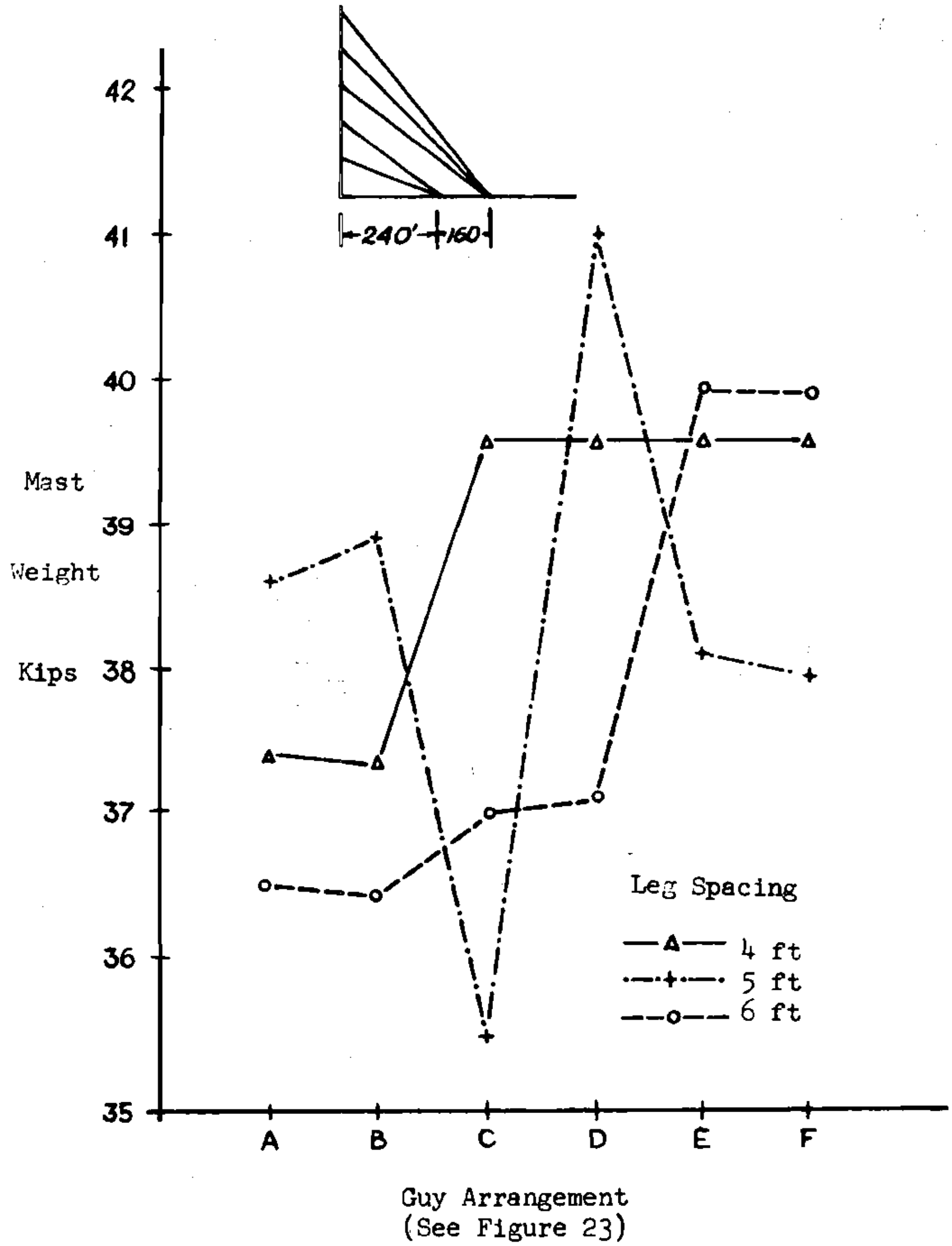


Figure 29 Guy Arrangement, Anchor Spacing, and Leg Spacing Compared to Mast Weight, 500 Foot Tower

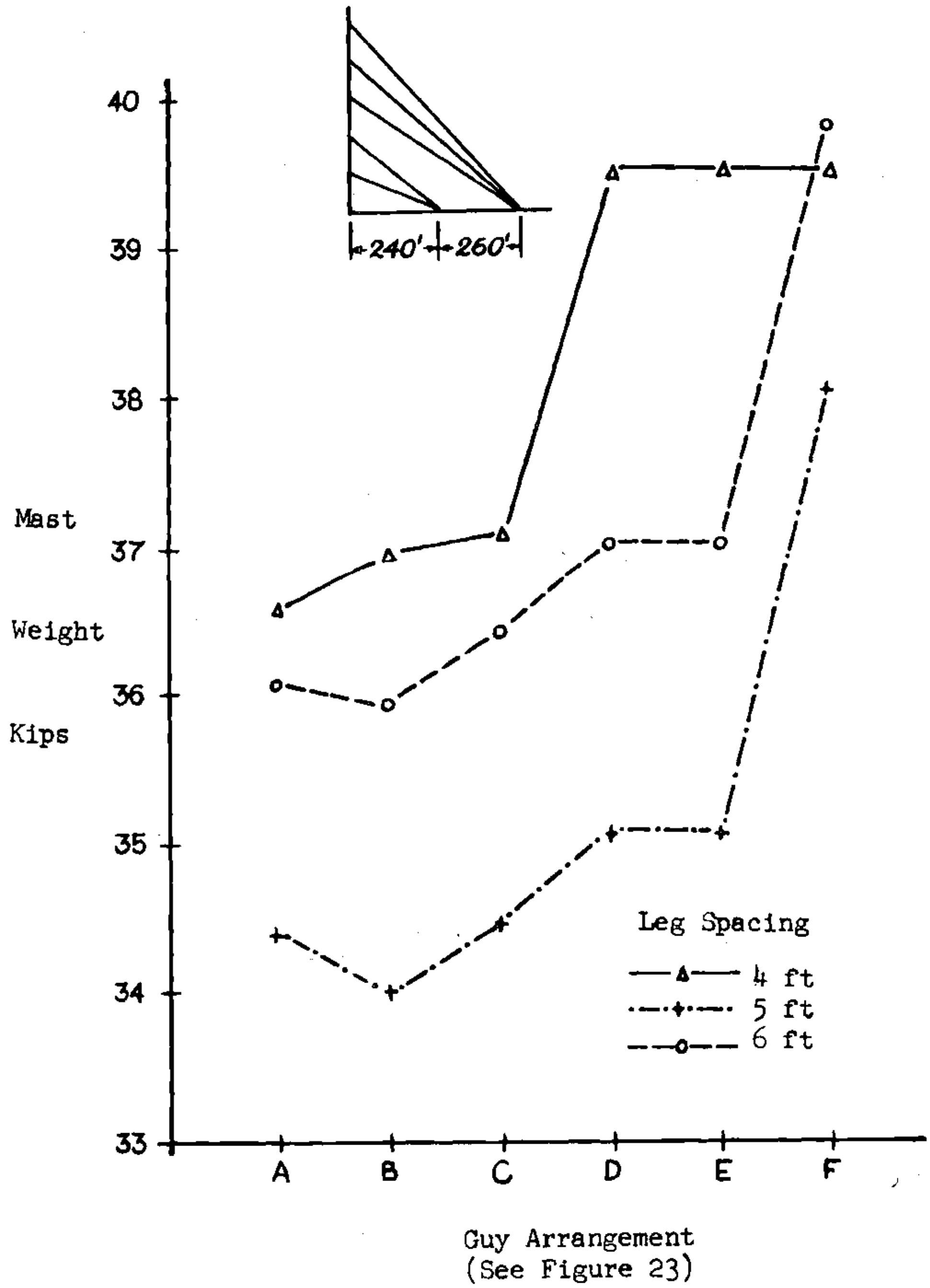


Figure 30 Guy Arrangement, Anchor Spacing, and Leg Spacing Compared to Mast Weight, 500 Foot Tower

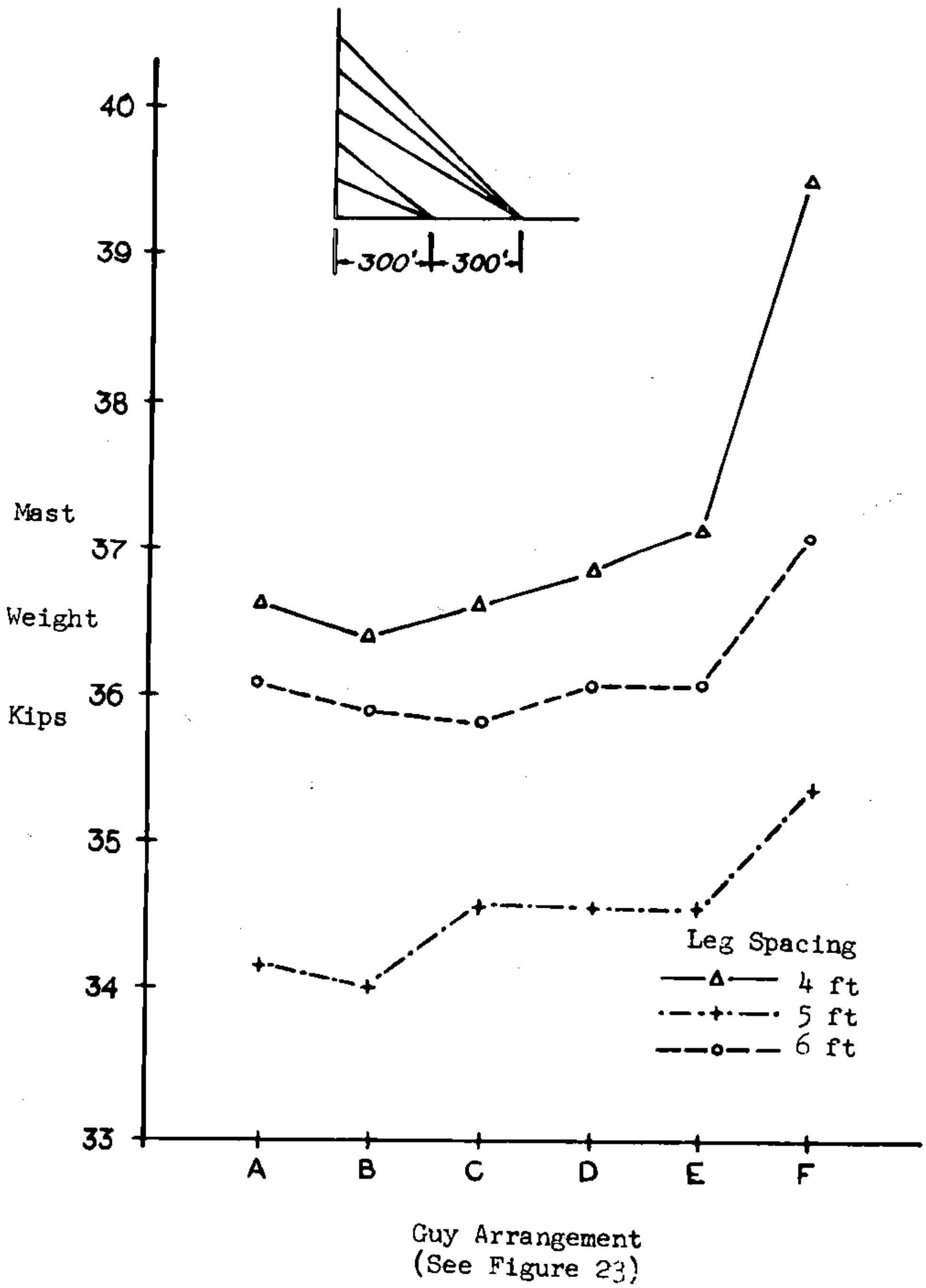
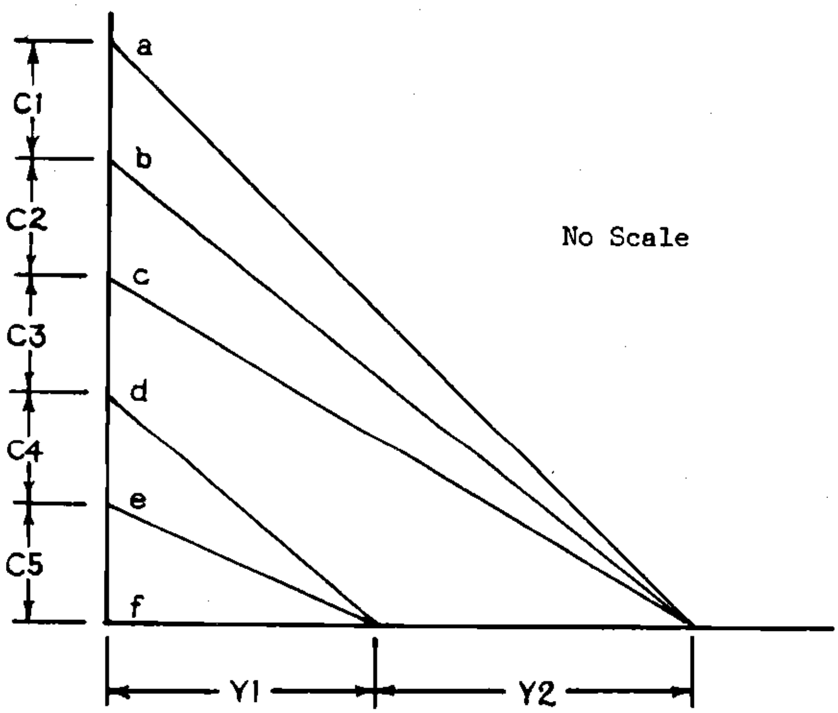


Figure 31 Guy Arrangement, Anchor Spacing, and Leg Spacing Compared to Mast Weight, 500 Foot Tower



Guy Arrangements

	A	B	C	D	E
C1	200	180	140	120	80
C2	160	150	140	140	100
C3	140	140	140	140	140
C4	100	120	140	150	200
C5	100	110	140	150	200

Figure 32 Guy and Anchor Arrangements for 700 Foot Tower

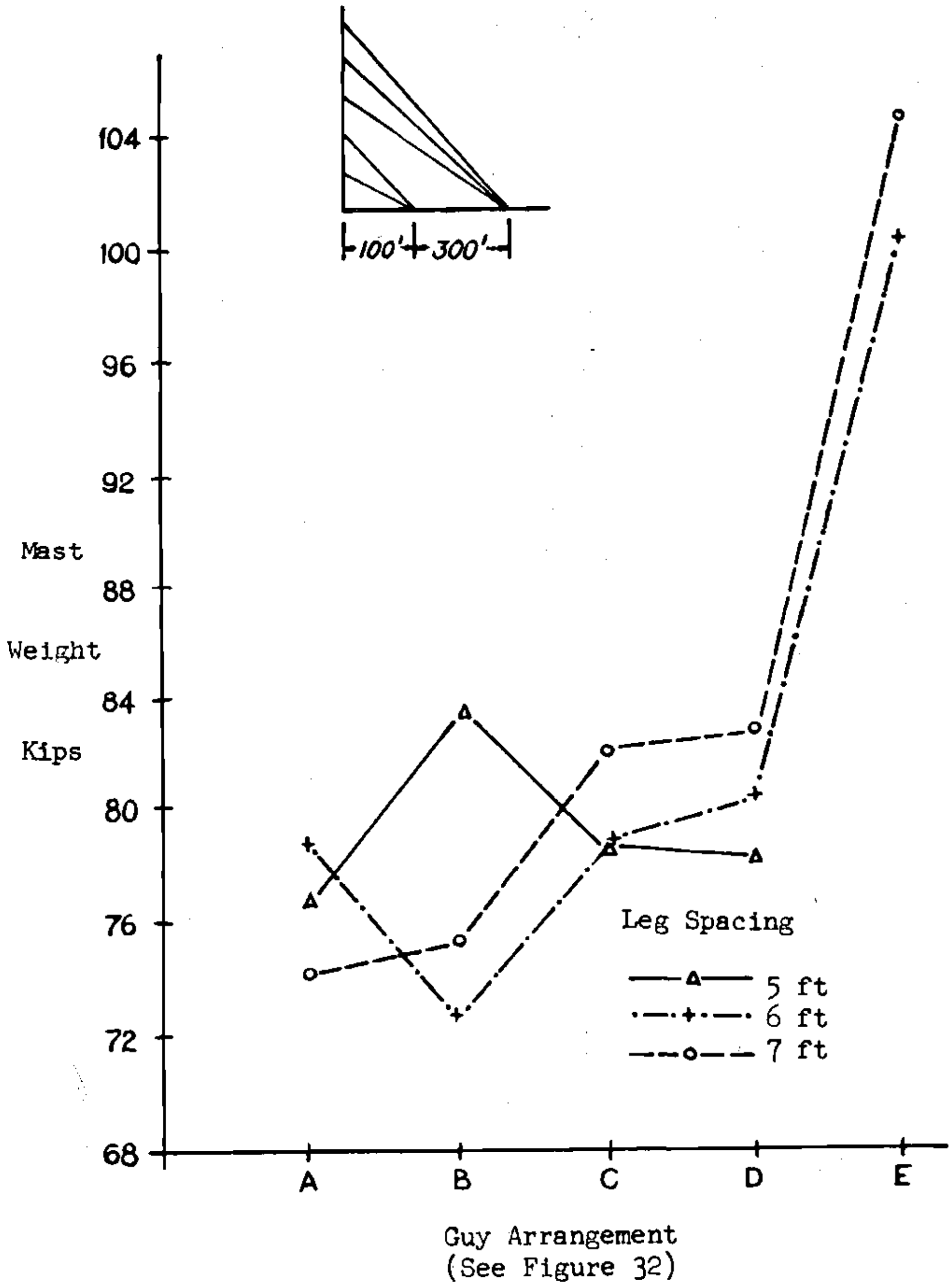


Figure 33 Guy Arrangement, Anchor Spacing, and Leg Spacing Compared to Mast Weight, 700 Foot Tower

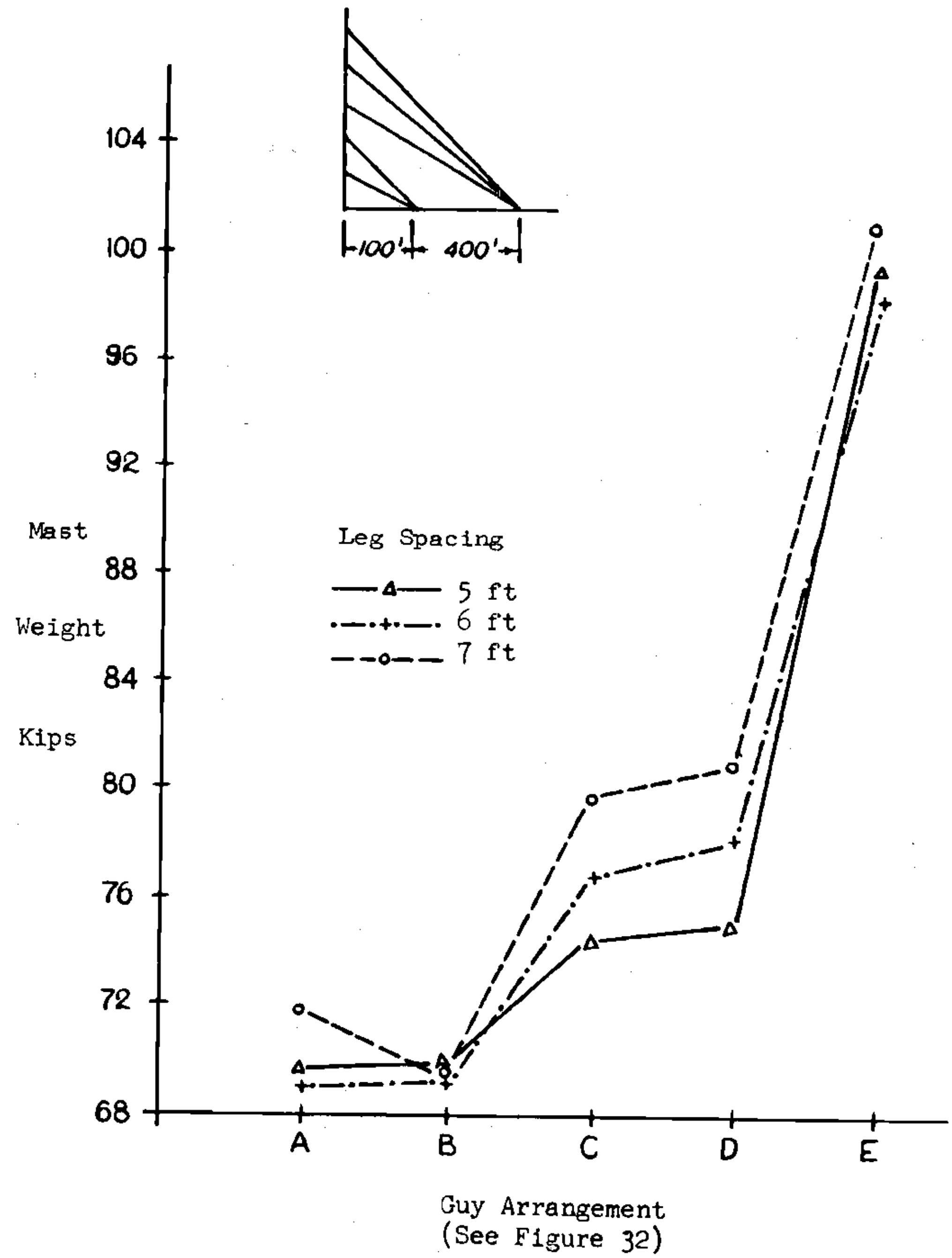


Figure 34 Guy Arrangement, Anchor Spacing, and Leg Spacing Compared to Mast Weight, 700 Foot Tower

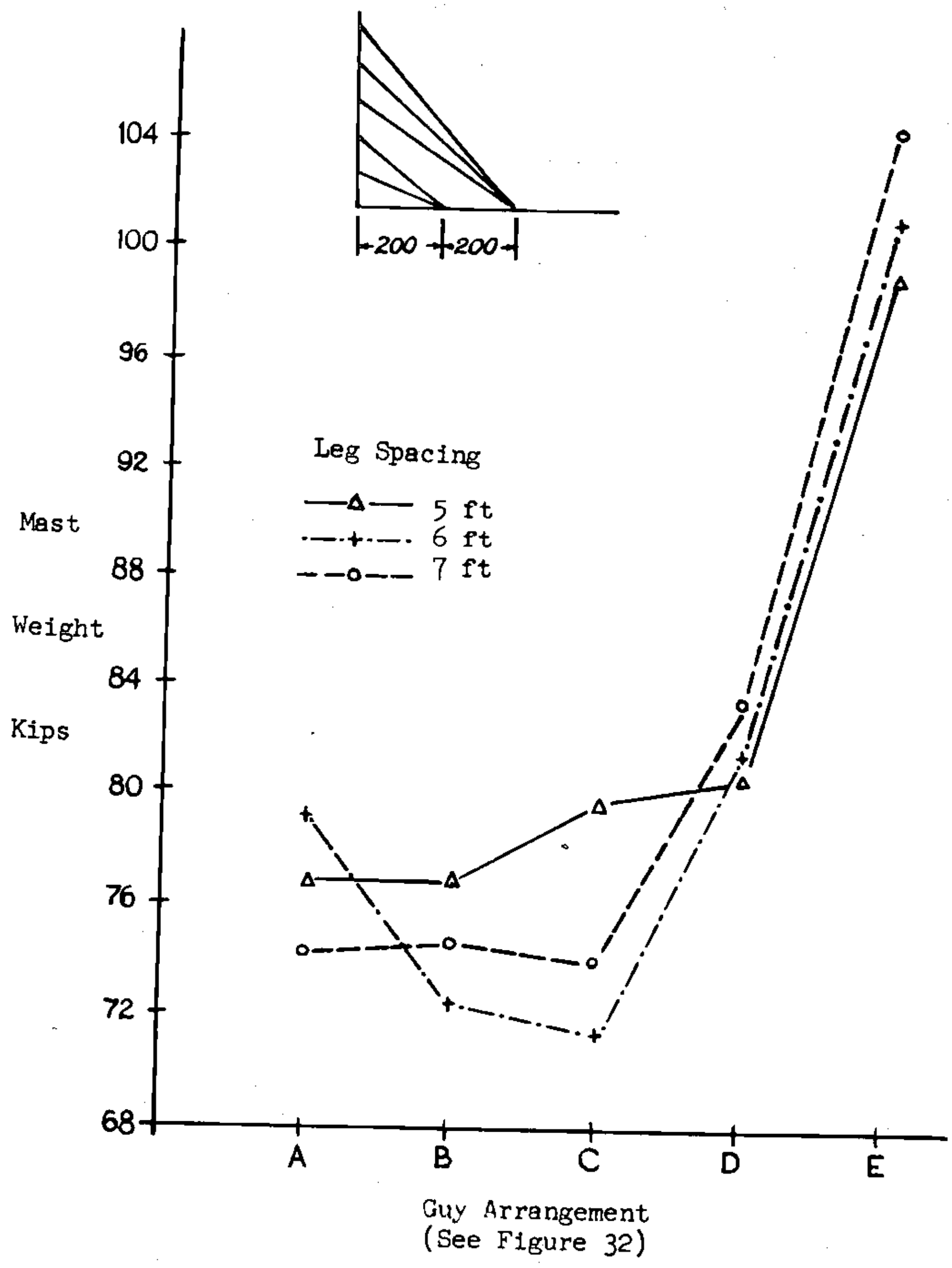


Figure 35 Guy Arrangement, Anchor Spacing, and Leg Spacing Compared to Mast Weight, 700 Foot Tower

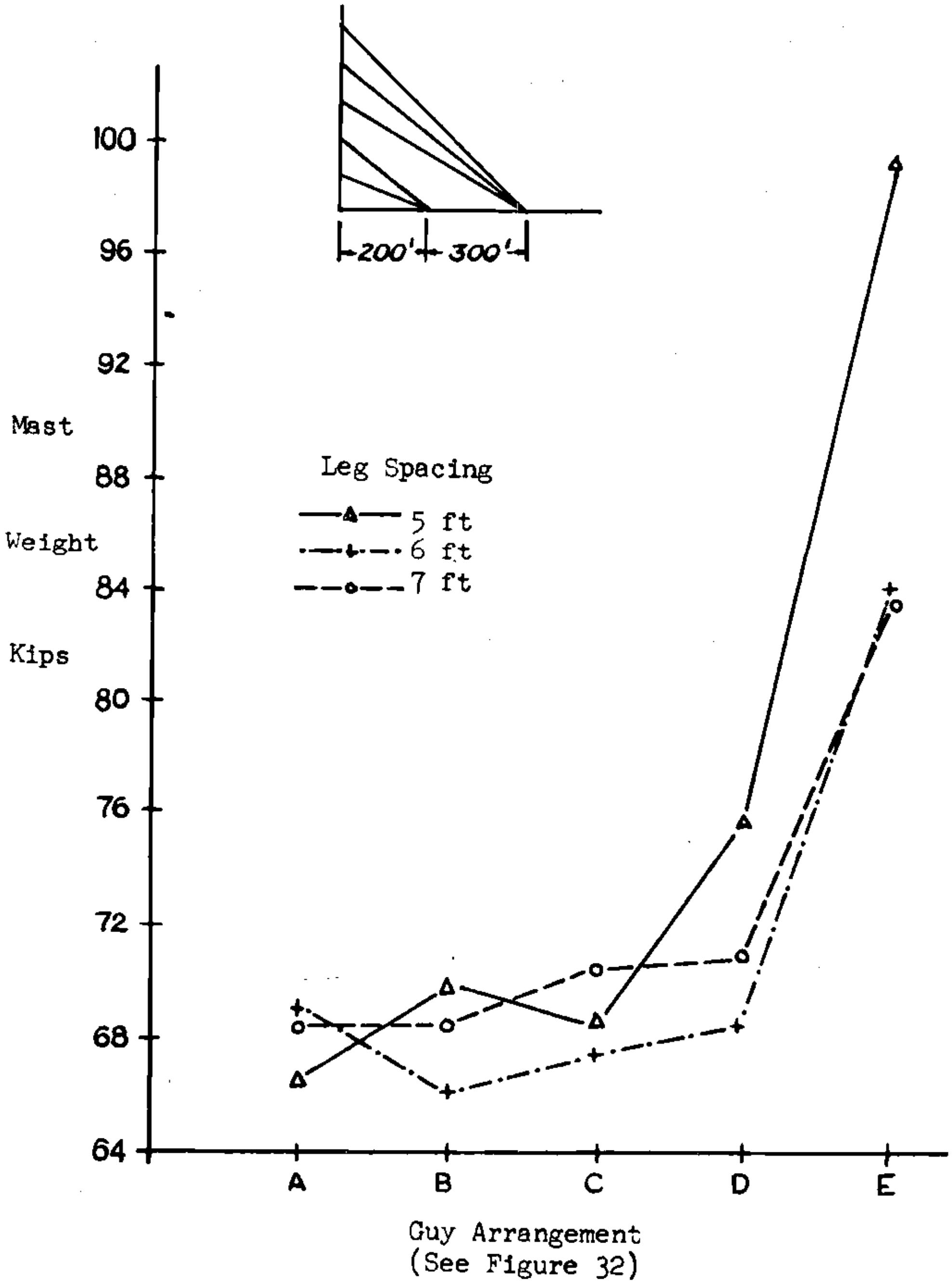


Figure 36 Guy Arrangement, Anchor Spacing, and Leg Spacing Compared to Mast Weight, 700 Foot Tower

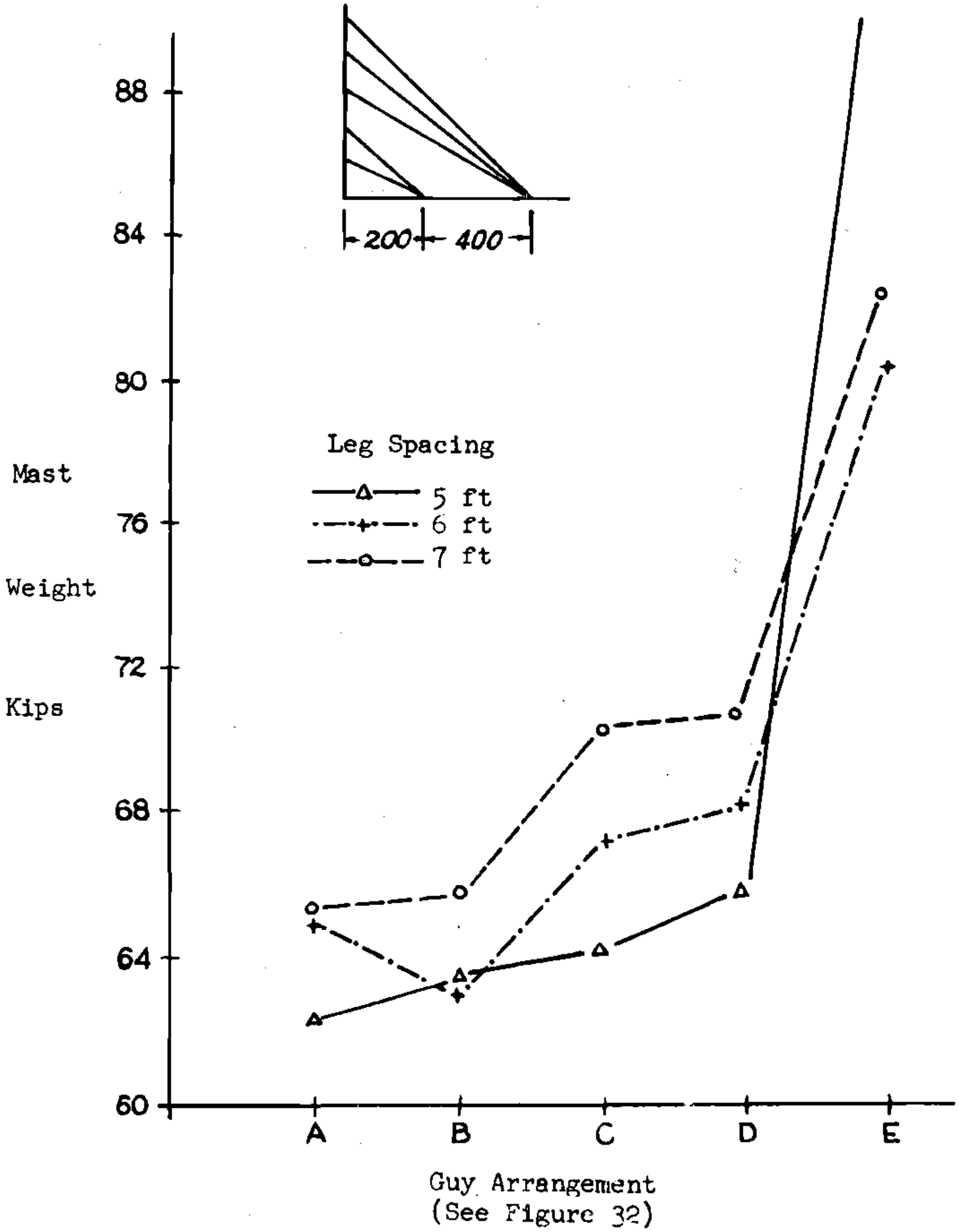


Figure 37 Guy Arrangement, Anchor Spacing, and Leg Spacing Compared to Mast Weight, 700 Foot Tower

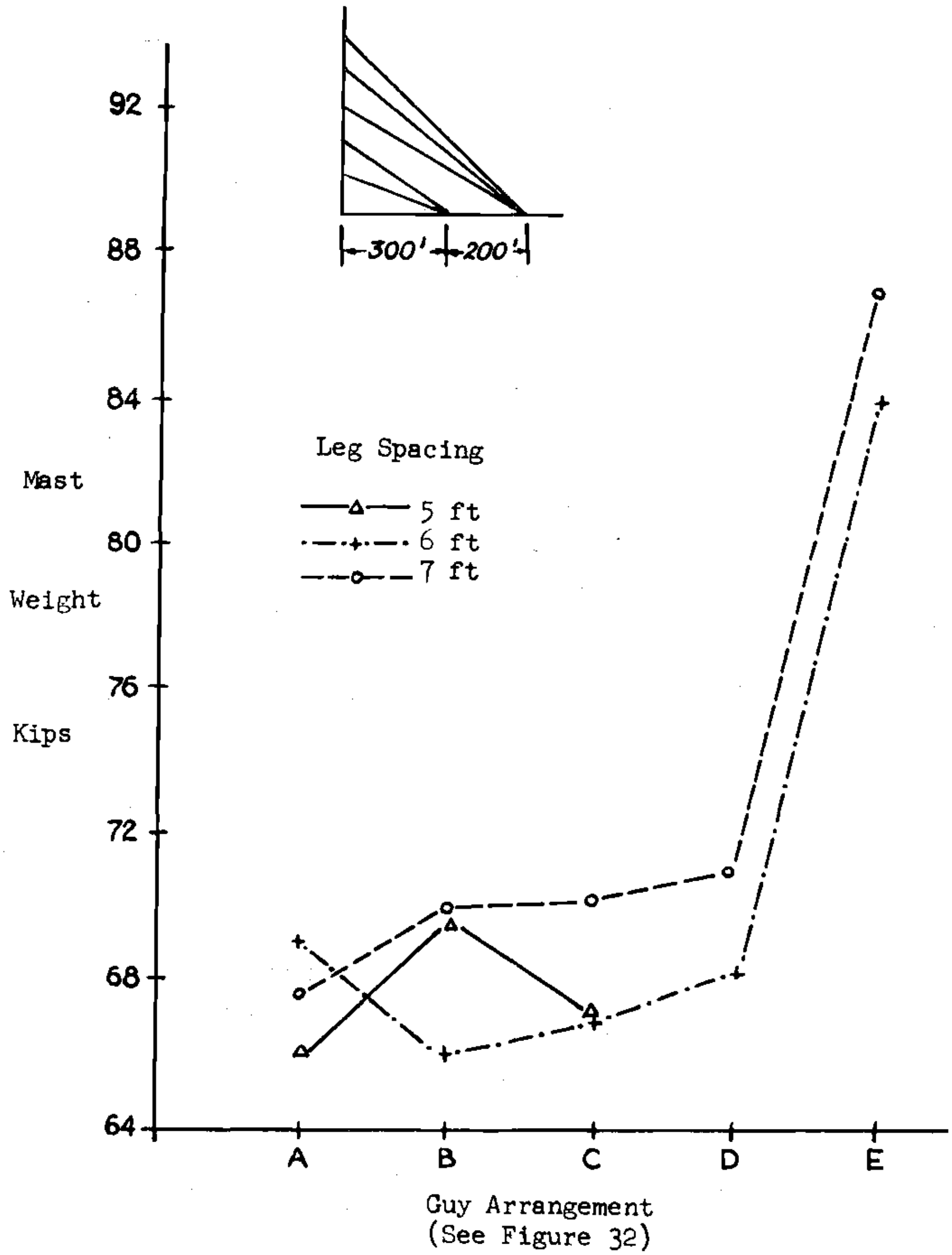


Figure 38 Guy Arrangement, Anchor Spacing, and Leg Spacing Compared to Mast Weight, 700 Foot Tower

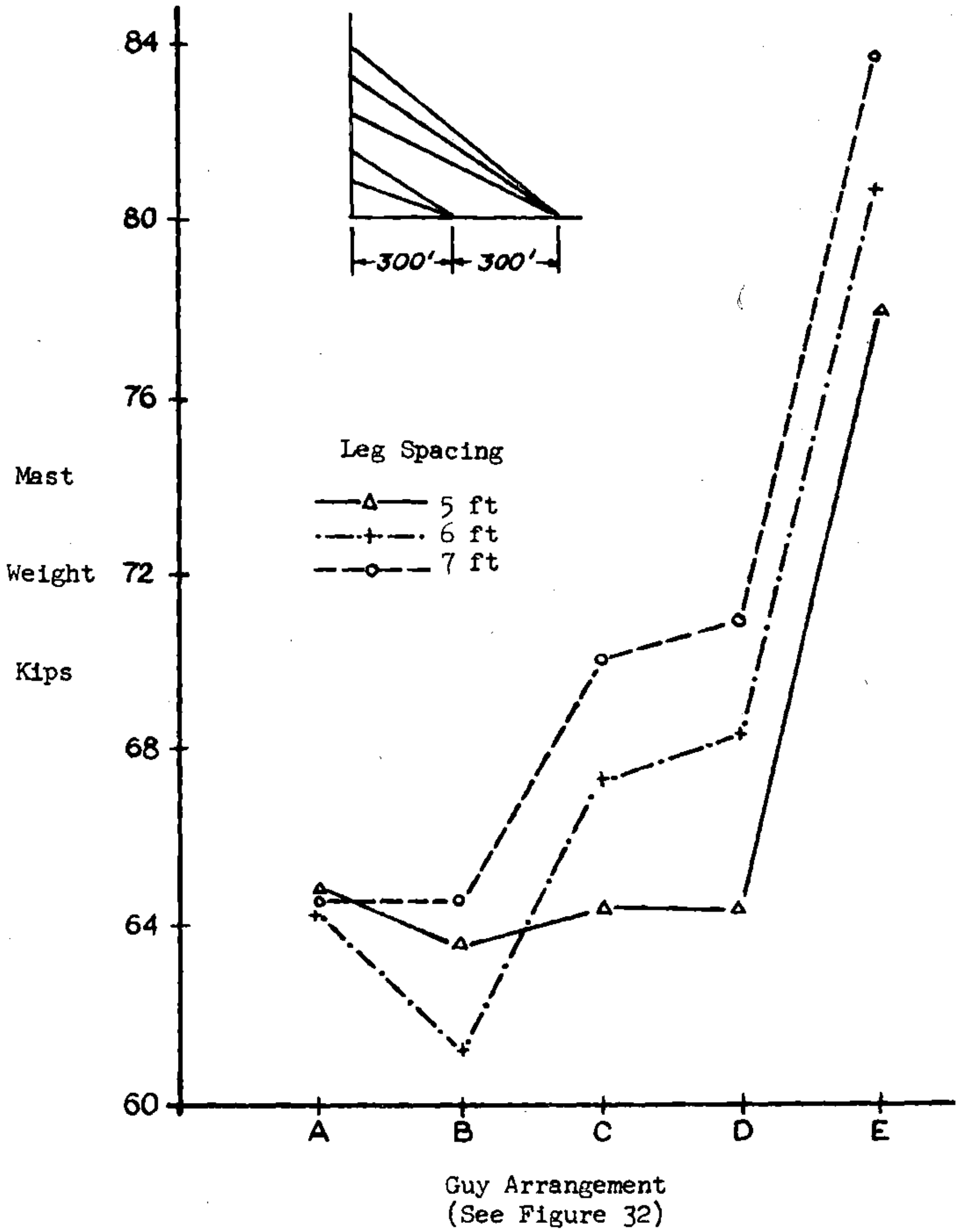
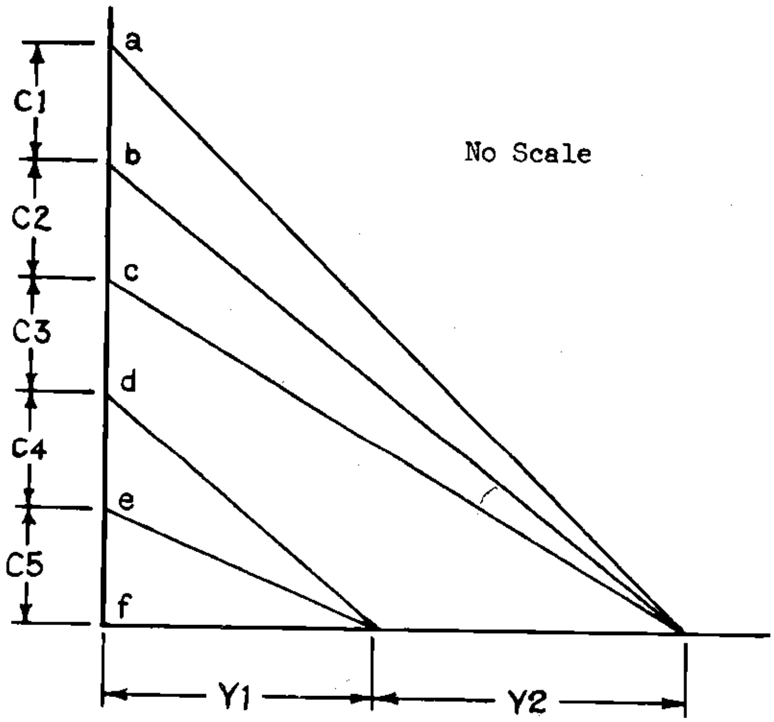


Figure 39 Guy Arrangement, Anchor Spacing, and Leg Spacing Compared to Mast Weight, 700 Foot Tower



Guy Arrangements

	A	B	C	D	E
C1	240	210	180	150	120
C2	210	190	180	180	160
C3	180	180	180	180	180
C4	140	160	180	190	200
C5	130	160	180	200	240

Figure 40 Guy and Anchor Arrangements for 900 Foot Tower

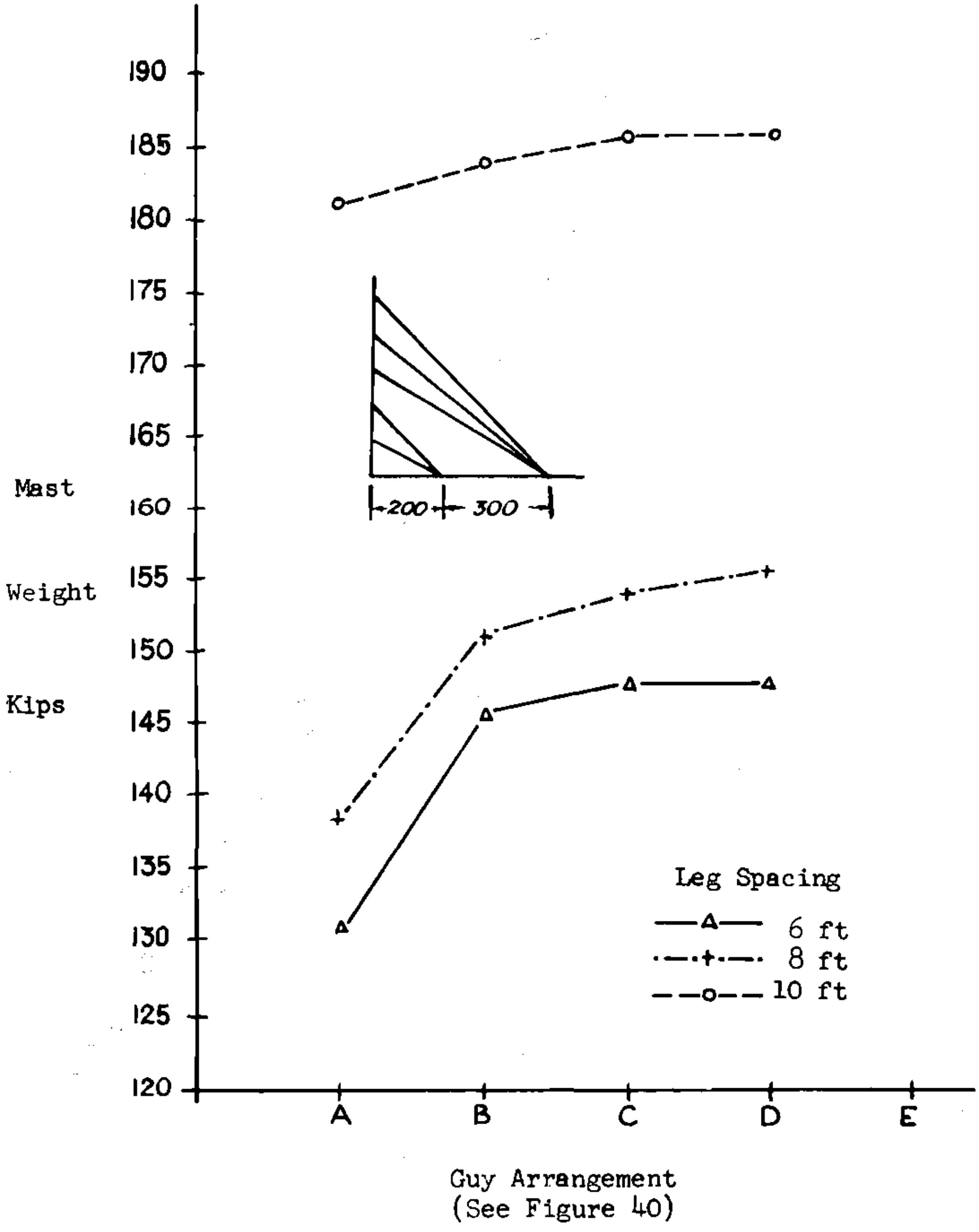


Figure 41 Guy Arrangement, Anchor Spacing, and Leg Spacing Compared to Mast Weight, 900 Foot Tower

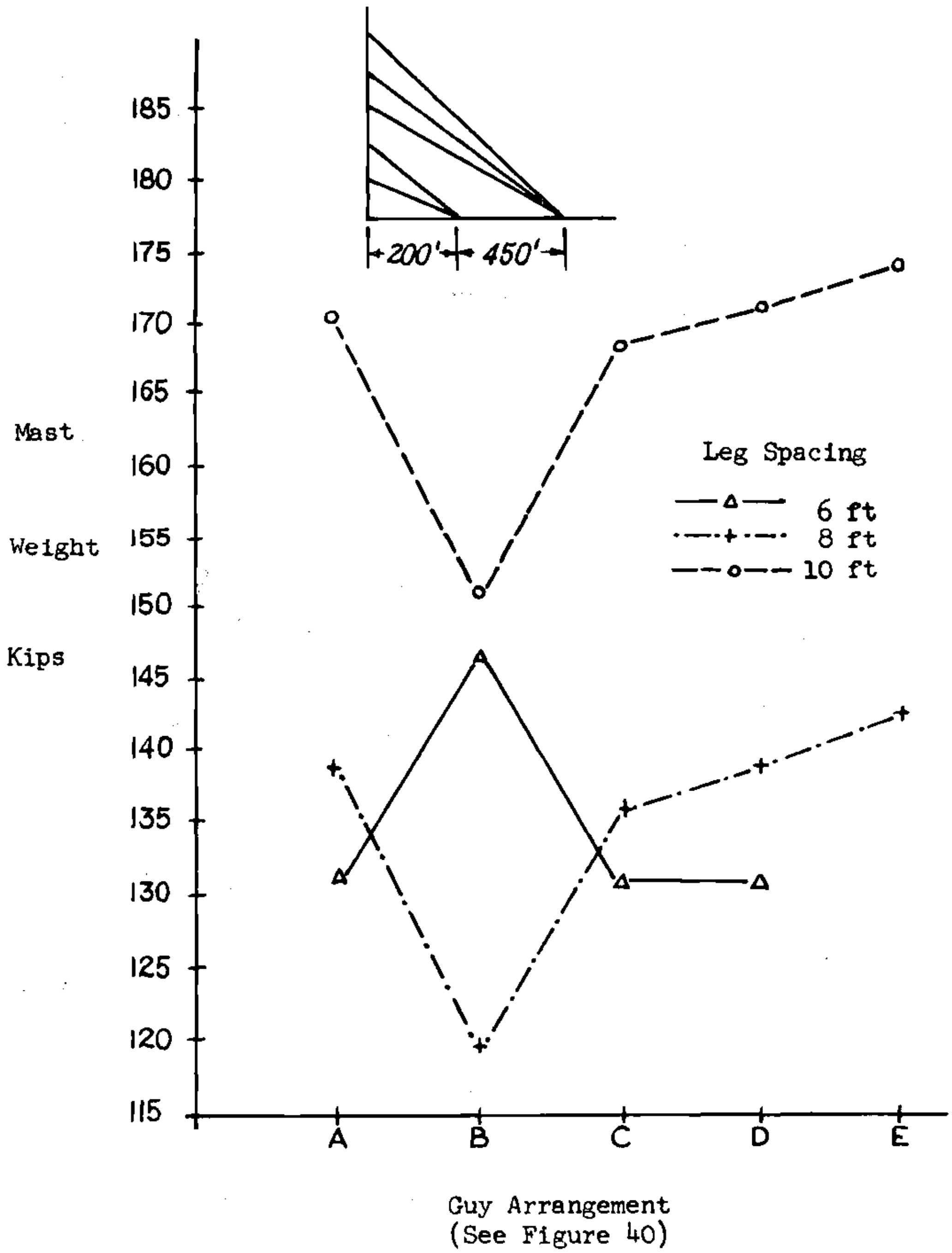


Figure 42 Guy Arrangement, Anchor Spacing, and Leg Spacing Compared to Mast Weight, 900 Foot Tower

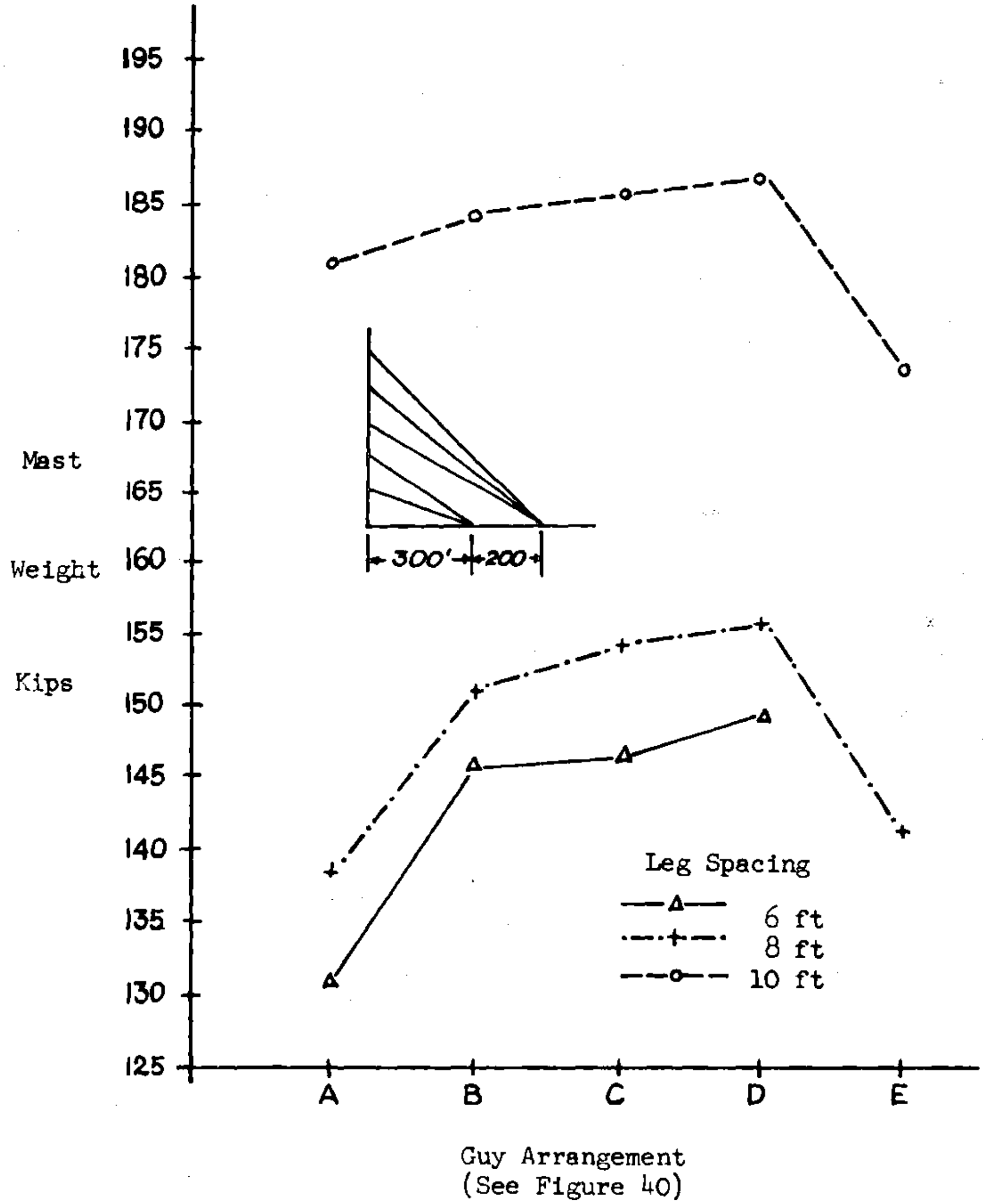


Figure 43 Guy Arrangement, Anchor Spacing, and Leg Spacing Compared to Mast Weight, 900 Foot Tower

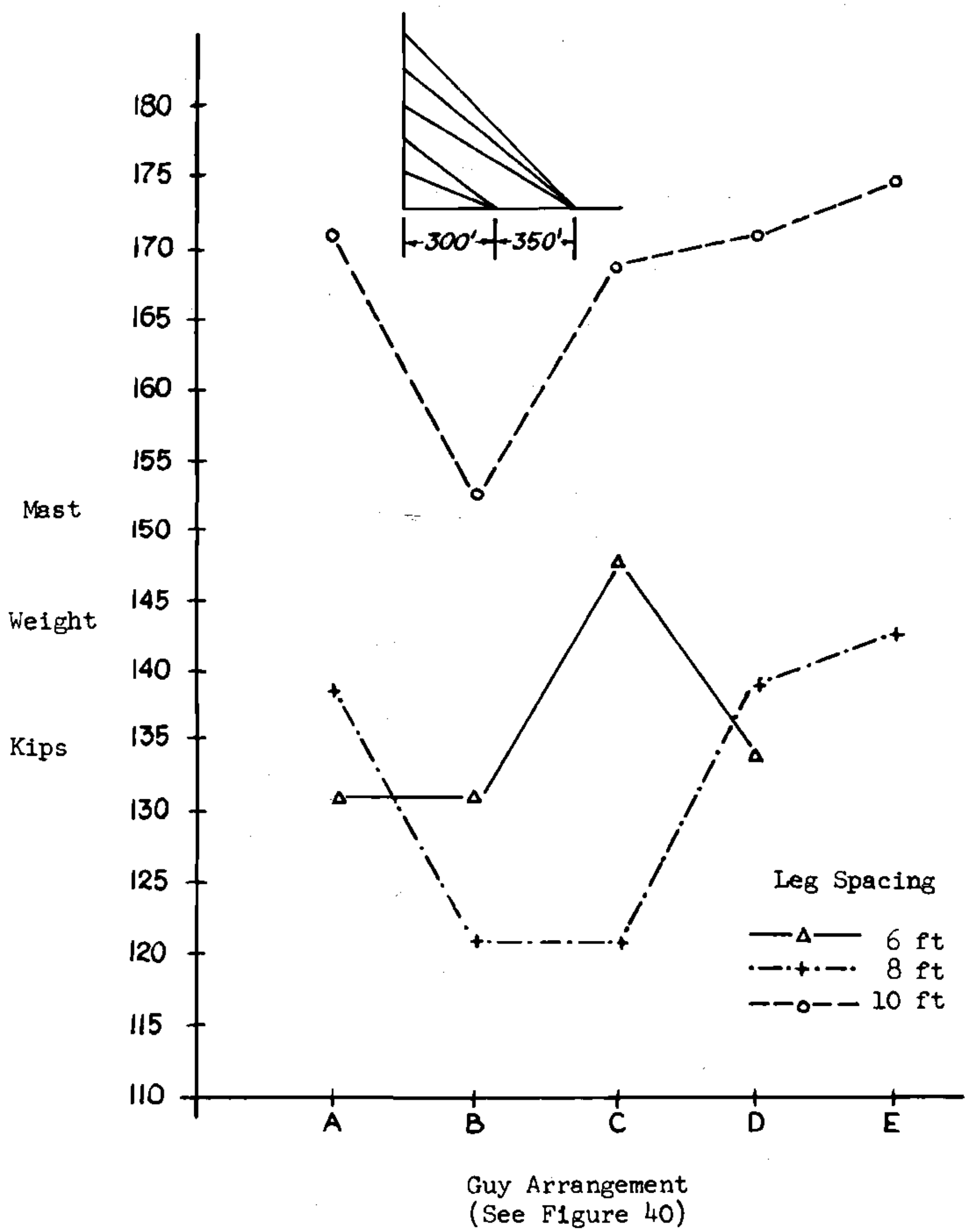


Figure 44 Guy Arrangement, Anchor Spacing, and Leg Spacing Compared to Mast Weight, 900 Foot Tower

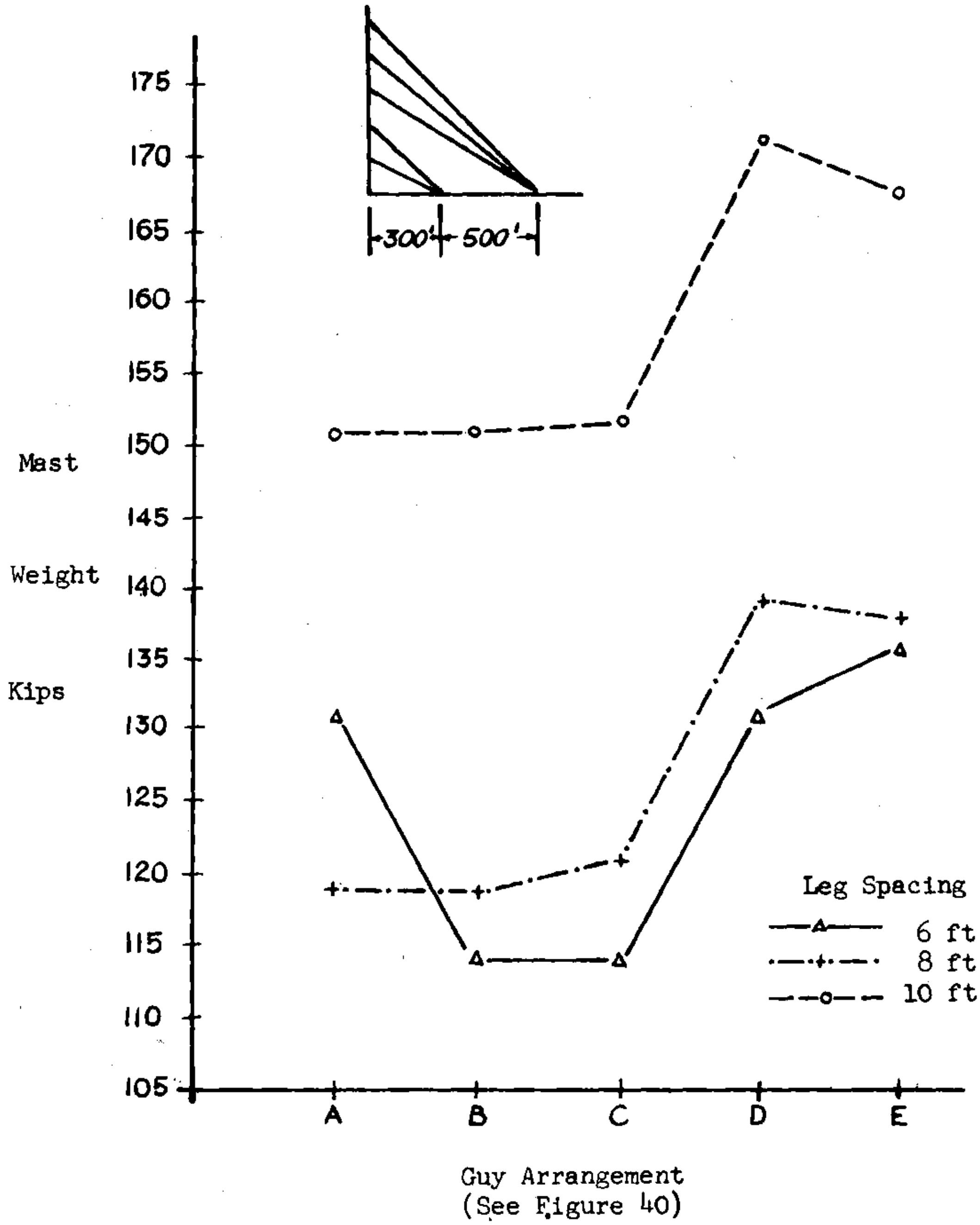


Figure 45 Guy Arrangement, Anchor Spacing, and Leg Spacing Compared to Mast Weight, 900 Foot Tower

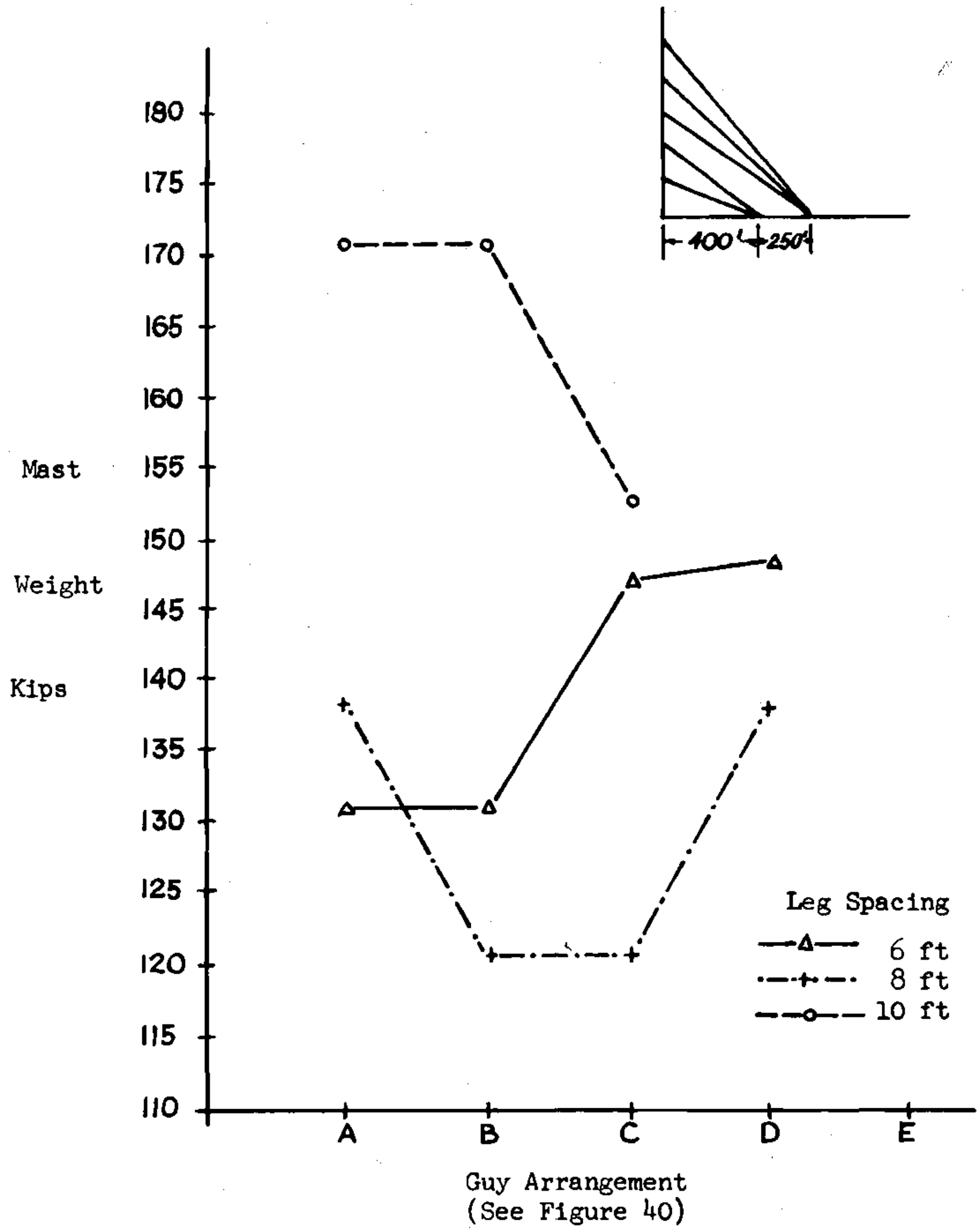


Figure 46 Guy Arrangement, Anchor Spacing, and Leg Spacing Compared to Mast Weight, 900 Foot Tower

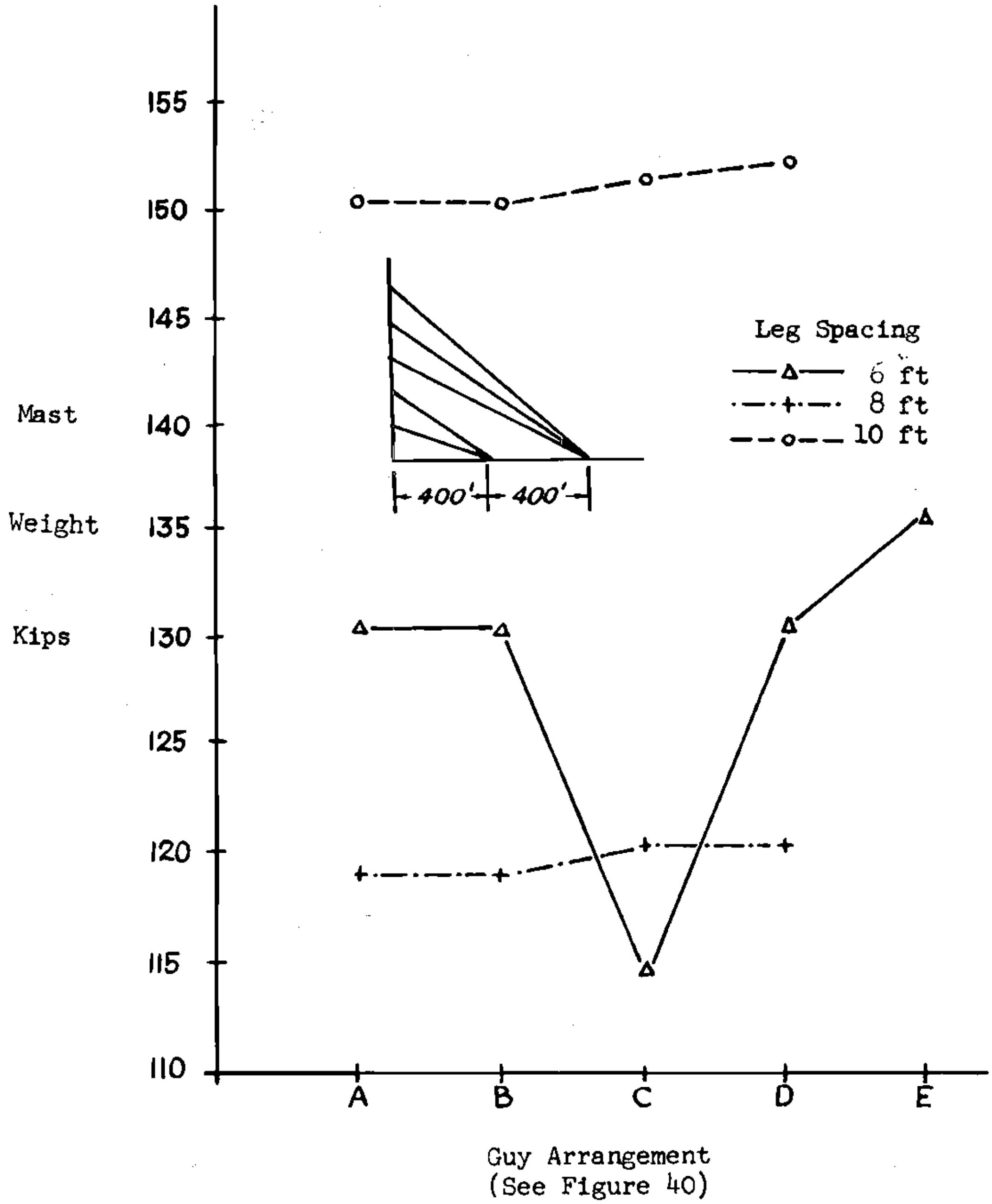


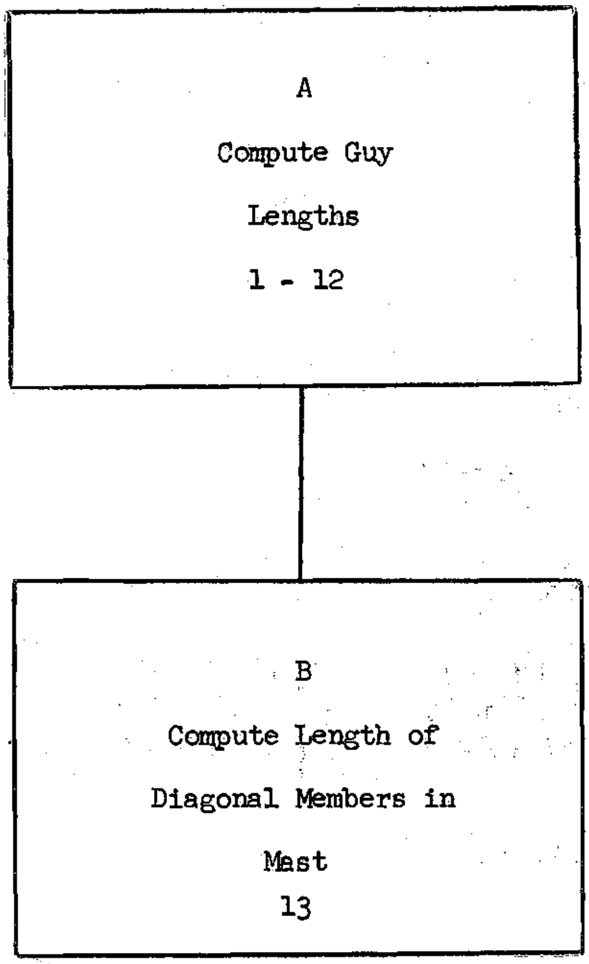
Figure 47 Guy Arrangement, Anchor Spacing, and Leg Spacing Compared to Mast Weight, 900 Foot Tower

APPENDIX B

FLOW DIAGRAM REPRESENTING THE SOLUTION AS PROGRAMMED FOR USE ON THE COMPUTER

The boxes shown below in the flow diagram are cross-referenced with the statements in the Runcible program in Appendix C. Numbers appearing in the flow diagram boxes refer to program statement numbers; the statements listed are for the operation noted in the box. The statement numbers in boxes A through M refer to Part 1 of the Runcible program.

Appendix D contains a key list of the variables in the Runcible program.



Based on assumed location of anchors and points of guy attachment to the mast

Based on assumed leg spacing and lay-out of mast

C

Compute Wind Load Per

Linear Foot Of Mast

14 - 16

Based on assumed member sizes, wind load pattern, and shape factors

D

Compute Fixed-End

Moments

17 - 21

Based on standard approach to moment - distribution

E

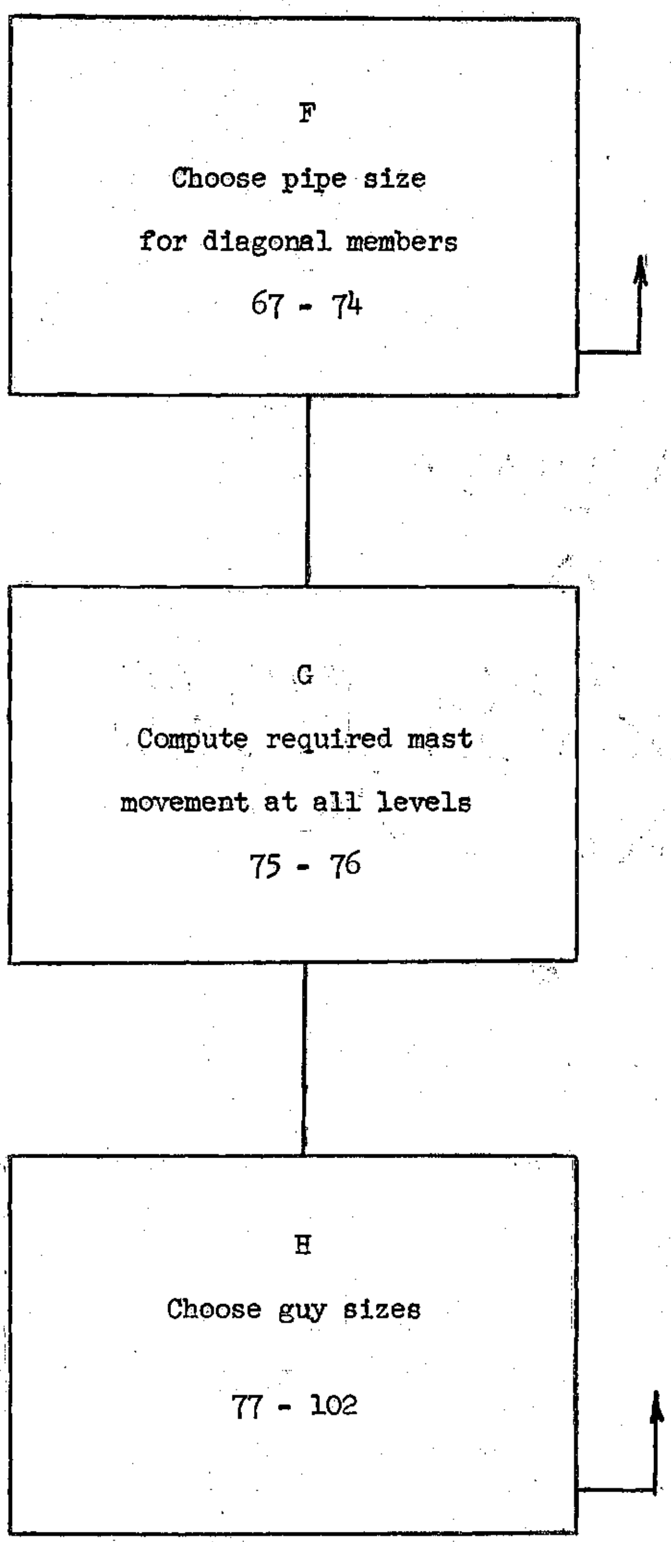
Compute Mast Reactions

And Bending Moments

In Mast

22 - 65

Based on moment distribution applied to continuous beam on unyielding supports with no axial load



Diagonal members resist shear in the mast; programs loops back to box C until proper size is chosen

Based on assumed size for top set of guys, and straight line mast tilt under wind load

Choose sizes that will permit correct amount of movement at each guy level on the mast; program loops back to box A until requirement is met

I

Compute horizontal component of leeward guy force

103 - 106

Computes remaining increment of initial tension

J

Compute horizontal component of windward guy force

108

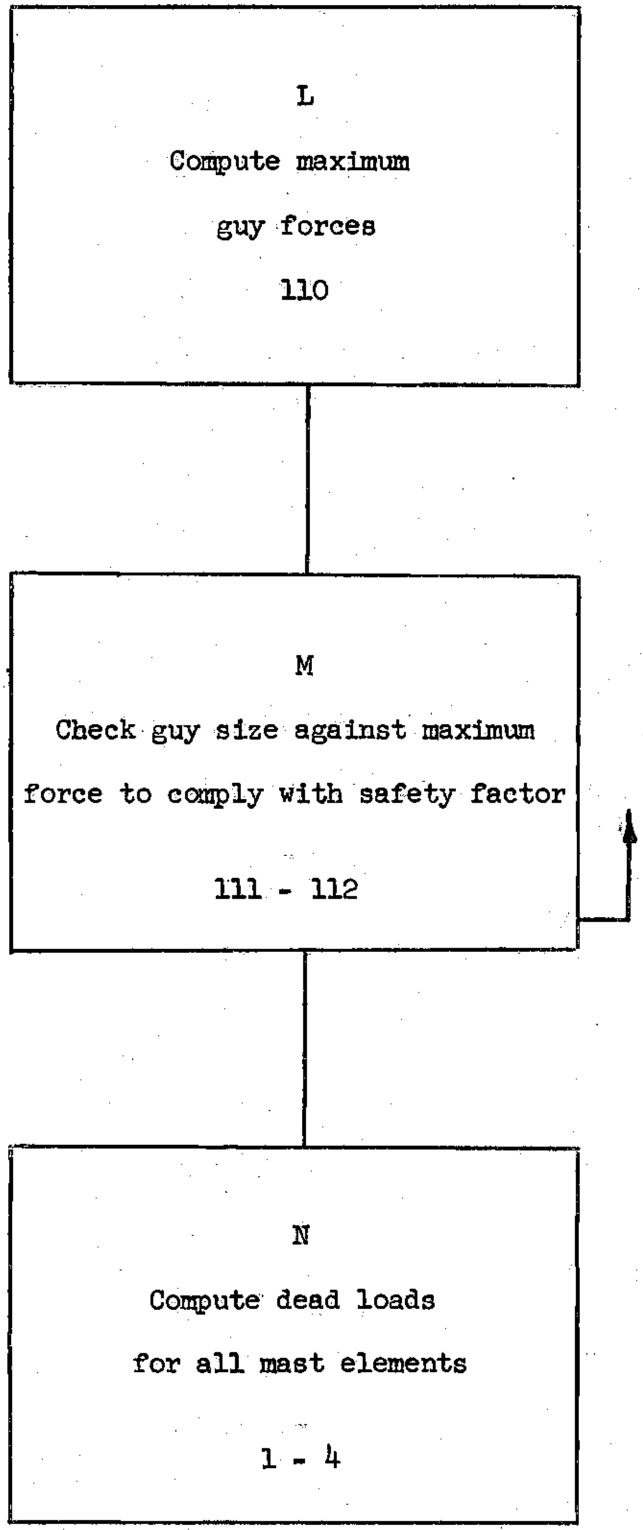
Wind load plus remaining increment of initial tension

K

Compute vertical component in windward guys

109

Includes one-half dead load of guy



Combine horizontal and vertical components

Program loops back to box A if safety factor not adequate

The statement numbers in boxes N through R refer to Part 2 of the Runcible program

Based on assumed sizes for structural elements plus added hardware

O

Choose leg size at top of mast

5 - 9

Check assumed size of worst-loaded leg; leg acts as a column. Program loops back to box N until adequate size is chosen

P

Check mast as column between guy levels

10 - 26

Program loops back to box N until adequate leg size is furnished

Q

Repeat leg check and mast check at each guy level

27 - 115

R Compute Mast Weight 116

APPENDIX C

RUNCIBLE PROGRAM

FOR

GUYED AERIAL TOWER DESIGN

RUNCIBLE PROGRAM FOR

GUYED AERIAL TOWER DESIGN

Part 1

			Flow diagram box - Appendix B
1	READ	F	A
2	C10 Z C5	F	"
3	C6 Z C1 S C2 S C3 S C4 S C10	F	"
4	C7 Z C6 M C1	F	"
5	C8 Z C7 M C2	F	"
6	C9 Z C8 M C3	F	"
7	Y3 Z Y1 S Y2	F	"
8	11KI1K8K1K12K	F	"
9	Y5 Z Y3 IF I1 U 11	F	"
10	Y3 Z Y1 IF I1 U 11	F	"
11	YI1 Z Q20EK LLCLI1 M 2RR X		"
	LCLI1 M 2RRR S LY3 X Y3 RQ	F	
12	Y3 Z Y5	F	"
13	Y13 Z Q20EK 25 S LY4 X Y4 RQ	F	B
14	Y14 Z 15J X LLLY13 S Y4 R X		
	Y125R S L10J X Y126RR	F	C
15	Y15 Z L13J5 X Y14R D 15J	F	"
16	Y16 Z L12J X Y15R D 13J5	F	"
17	Y31 Z Y14 X C1 X C1 D 12J	F	D
18	Y32 Z Y14 X C2 X C2 D 12J	F	"
19	Y33 Z Y15 X C3 X C3 D 12J	F	D

			Flow diagram box
20	Y34 Z Y15 X C4 X C4 D 12J	F	D
21	Y35 Z Y16 X C10 X C10 D 12J	F	"
22	Y40 Z Y127 M Y31R	F	E
23	Y41 Z MLLY31 M Y32R D 2JR	F	"
24	Y42 Z MLLY32 M Y33R D 2JR	F	"
25	Y43 Z MLLY33 M Y34R D 2JR	F	"
26	Y44 Z MLLY34 M Y34R D 2JR	F	"
27	Y45 Z Y44 D 2J	F	"
28	Y46 Z Y35 D 2J	F	"
29	Y47 Z Y43 D 2J	F	"
30	Y48 Z Y42 D 2J	F	"
31	Y49 Z Y41 D 2J	F	"
32	Y50 Z Y40 D 2J	F	"
33	Y51 Z LY47 S Y46R D 2J	F	"
34	Y52 Z LY48 X Y45 R D 2J	F	"
35	Y53 Z LY49 S Y47R D 2J	F	"
36	Y54 Z LY50 S Y48R D 2 J	F	"
37	Y55 Z MY51 D 2J	F	"
38	Y56 Z MY45 D 2J	F	"
39	Y57 Z MY52 D 2J	F	"
40	Y58 Z MY53 D 2J	F	"
41	Y59 Z MY54 D 2J	F	"
42	Y60 Z MY49 D 2J	F	"
43	Y61 Z LY60 S Y58R D 2J	F	E
44	Y62 Z LY59 S Y57R D 2J	F	"

			Flow diagram box
45	Y63 Z LY58 S Y55R D 2J	F	E
46	Y64 Z LY57 S Y56R D 2J	F	"
47	Y65 Z MY64 D 2J	F	"
48	Y66 Z MY55 D 2J	F	"
49	Y67 Z MY63 D 2J	F	"
50	Y68 Z MY62 D 2J	F	"
51	Y69 Z MY61 D 2J	F	"
52	Y70 Z MY59 D 2J	F	"
53	Y71 Z LY67 S Y66R D 2J	F	"
54	Y72 Z LY68 S Y65R D 2J	F	"
55	Y73 Z LY69 S Y67R D 2J	F	"
56	Y74 Z LY70 S Y68R D 2J	F	"
57	Y17 Z Y32 M Y41 S Y48 M Y54		
	S Y58 M Y61 S Y68 M Y74	F	"
58	Y18 Z Y33 M Y42 S Y47 M Y53		
	S Y57 M Y62 S Y67 M Y73	F	"
59	Y19 Z Y34 M Y43 S Y45 M Y52		
	S Y55 M Y63 S Y65 M Y72	F	"
60	Y20 Z Y35 M Y44 S Y46 M Y51		
	S Y56 M Y64 S Y66 M Y71	F	"
61	Y21 Z Y128 S LY14 X C1 D 2JR		
	S LLY127 M Y17R D C1R	F	"
62	Y22 Z LLY14 X C1R D 2JR S LY14		
	X C2 D 2JR S LLY17 M Y18R D C2R	F	"

		Flow diagram box	
63	Y23 Z LY15 X C4 D 2JR S LY14 X		
	C2 D 2JR S LLY18 M Y19R D C3R		
	S LLY18 M Y17R D C2R	F	E
64	Y24 Z LY15 X C4 D 2JR S LY15		
	X C3 D 2JR S LLY19 M Y20R D		
	C4R S LLY19 M Y18R D C3R	F	"
65	Y25 Z LY16 X C10 D 2JR S LY15		
	X C4 D 2JR S LY20 D C10R S		
	LLY20 M Y19R D C4R	F	"
66	....		
67	Y6 Z 8B2 X Y13 D L17B3 M		
	L485BM3 X LL144J X Y13 S Y13R		
	D LCI15 X CI15RRRR	F	F
68	JUMP TO 74 IF CI17 W Y6	F	"
69	I15 Z I15 S 1	F	"
70	I16 Z I16 S 1	F	"
71	I17 Z I17 S 1	F	"
72	I18 Z I18 S 1	F	"
73	JUMP TO 14	F	"
74	BYPASS	F	"
75	Y26 Z LLY21 S L40J X CI11 X		
	Y8RR X Y8R D LI5B6 X CI12R	F	G
76	111KI1K26K1K30K	F	"
77	I7 Z 11	F	H
78	I8 Z 21	F	"
79	I9 Z 31	F	"

			Flow diagram box
80	I10 Z 41	F	H
81	YI1 Z LCLI1M20RR X Y26 D C6	F	"
82	....		
83	JUMP TO 97 IF I1 U 26	F	"
84	Y7 Z CI7 X 40J	F	"
85	YLI1S10R Z LLYLI1M5RR S LY7 X LYLI1M18RRRR X LYLI1M18RR D LCI8 X 15B6R	F	"
86	JUMP TO 103 IF C135 W ALLYI1R M YLI1S10RR	F	"
87	JUMP TO 90 IF YLI1S10R W YI1	F	"
88	YI1 Z ALLYI1R M YLI1S10RR	F	"
89	JUMP TO 1	F	"
90	I7 Z I7 S 1	F	"
91	I8 Z I8 S 1	F	"
92	I9 Z I9 S 1	F	"
93	I10 Z I10 S 1	F	"
94	JUMP TO 84	F	"
95	....		
96	....		
97	I7 Z I11	F	H
98	I8 Z I12	F	"
99	I9 Z I13	F	"
100	I10 Z I14	F	"

			Flow diagram box
101	Y5 Z Y3	F	H
102	Y3 Z Y1	F	"
103	YLI1S15R Z LLCI10R X LYLI1		
	M18RR X LYLI1M18RRR D 64B3	F	I
104	....		
105	Y36 Z Y26	F	"
106	YLI1S20R Z L8B3R X Y3 D Q20EKLL		
	Y3 X CI10 X CI10 X YLI1M18R X		
	YLI1M18RR S L15964B6R X YLI1		
	S 10RR D LY3 X CI10 X CI10RQ	F	"
107	....		
108	YLI1S25R Z LYLI1S20RR S		
	LLI15BM2R X LYLI1M5R S LY7 X		
	YLI1M18RRRR	F	J
109	YLI1S30R Z LLCLI1M20R X		
	YLI1S25RR D Y5R S LCI10 X		
	YLI1M18R D 2JR	F	K
110	YLI1S35R Z Q20EK LYLI1S25R		
	X YLI1S25RR S LYLI1S30R X		
	YLI1S30RR Q	F	L
111	YLI1S40R Z LYLI1S35RR D CI9	F	M
112	JUMP TO 1	FF	"

The program was divided into two parts because of its length, which overtaxed the memory of the computer.

Part 2

			Flow diagram box
1	READ	F	N
2	Y3 Z Y5	F	"
3	Y71 Z L500JR S L60J X CI6R		
	S LLY4 S Y13R X CI18 X 12JR	F	"
4	Y72 Z L500JR S L60J X CI22R		
	S LLY4 S Y13R X CI18 X 12JR	F	"
5	Y73 Z 0J866 X Y4	F	O
6	Y74 Z Y127 D Y73	F	"
7	Y75 Z LC6 X Y46 D Y3R S LCI14		
	X Y8 D 2JR	F	"
8	Y76 Z 17B3 M L1746J D CI3 X		
	CI3R	F	"
9	Y77 Z LY74 S Y75 S 6000JR D Y76	F	"
10	Y78 Z Y46 S LY21 S LCI11 X		
	Y8 X 40JRR	F	P
11	Y79 Z LC6 X Y78 D Y3R S		
	LCI14 X Y8 D 2JR	F	"
12	Y80 Z Y79 S Y79 S Y75 S 18B3	F	"
13	Y81 Z 17B3 M LL292BM2 X C1 X		
	C1R D LY4 X Y4RR	F	"
14	Y82 Z LY80 D L3J X CI5 X Y81RR		
	S LY74 D LCI5 X 2B4RR	F	"

			Flow diagram box
15	JUMP TO 21 IF CI5 W Y77	F	P
16	I3 Z I3 S 1	F	"
17	I4 Z I4 S 1	F	"
18	I5 Z I5 S 1	F	"
19	I6 Z I6 S 1	F	"
20	JUMP TO 3	F	"
21	JUMP TO 27 IF 1J W Y82	F	"
22	I3 Z I3 S 1	F	"
23	I4 Z I4 S 1	F	"
24	I5 Z I5 S 1	F	"
25	I6 Z I6 S 1	F	"
26	JUMP TO 3	F	"
27	Y83 Z Y17 D Y73	F	Q
28	Y84 Z LC1 X Y71R D 60J	F	"
29	Y85 Z LC7 X Y47 D Y3R S		
	LCI10 X Y9 D 2JR	F	"
30	Y86 Z 6B3 S Y75	F	"
31	Y87 Z LY83 S Y84 S Y85 S		
	Y86R D Y76	F	"
32	Y88 Z Y47 S LY22 S LCI7 X		
	40J X Y9RR	F	"
33	Y89 Z LC7 X Y88 D Y3R S LCI10		
	X Y9 D 2JR	F	"
34	Y90 Z Y80 S Y89 S Y89 S Y85		
	S LC1 X Y71 D 20JR	F	"

			Flow diagram box
35	Y91 Z 17B3 M LL292BM2 X C2 X		
	C2R D LY4 X Y4RR	F	Q
36	Y92 Z LY90 D L3J X CI5 X Y91RR		
	S LY83 D LCI5 X 2B4RR	F	"
37	JUMP TO 43 IF CI5 W Y87	F	"
38	I3 Z I3 S 1	F	"
39	I4 Z I4 S 1	F	"
40	I5 Z I5 S 1	F	"
41	I6 Z I6 S 1	F	"
42	JUMP TO 3	F	"
43	JUMP TO 49 IF 1J W Y92	F	"
44	I3 Z I3 S 1	F	"
45	I4 Z I4 S 1	F	"
46	I5 Z I5 S 1	F	"
47	I6 Z I6 S 1	F	"
48	JUMP TO 3	F	"
49	Y93 Z Y18 D Y73	F	"
50	Y94 Z Y84 S Y85 S Y86	F	"
51	Y95 Z LC2 X Y71R D 60J	F	"
52	Y96 Z LC8 X Y48 D Y3R S LCI10		
	X Y10 D 2JR	F	"
53	Y97 Z LY93 S Y94 S Y95 S		
	Y 96R D Y76	F	"
54	Y98 Z Y48 S LY23 S LCI7 X		
	40J X Y10RR	F	"

			Flow diagram box
55	Y99 Z LC8 X Y98 D Y3R S LCI10		
	X Y10 D 2JR	F	Q
56	Y100 Z Y90 S Y99 S Y99 S Y96		
	S LC2 X Y71 D 20JR	F	"
57	Y101 X 17B3 M LL292BM2 X C3		
	X C3R D LY4 X Y4RR	F	"
58	Y102 Z LY100 D L3J X CI5 X		
	Y101RR S LY93 D LCI5 X 2B4RR	F	"
59	JUMP TO 65 IF CI5 W Y97	F	"
60	I3 Z I3 S 1	F	"
61	I4 Z I4 S 1	F	"
62	I5 Z I5 S 1	F	"
63	I6 Z I6 S 1	F	"
64	JUMP TO 3	F	"
65	JUMP TO 71 IF 1J W Y102	F	"
66	I3 Z I3 S 1	F	"
67	I4 Z I4 S 1	F	"
68	I5 Z I5 S 1	F	"
69	I6 Z I6 S 1	F	"
70	JUMP TO 3	F	"
71	Y103 Z Y19 D Y73	F	"
72	Y104 Z Y94 S Y95 S Y96	F	"
73	Y105 Z C3 X Y71 D 60J	F	"
74	Y106 Z LC9 X Y49 D Y1R S		
	LCI10 X Y11 D 2JR	F	"

			Flow diagram box
75	Y107 Z 17B3 M L1746J D CI19		
	X CI19R	F	Q
76	Y108 Z LY103 S Y104 S Y105		
	S Y106R D Y107	F	"
77	Y109 Z Y49 S LY24 S LCI7 X		
	40J X Y11RR	F	"
78	Y110 Z LC9 X Y109 D Y1R S		
	LCI10 X Y11 D 2JR	F	"
79	Y111 Z Y100 S Y110 S Y110 S		
	Y106 S LC3 X Y71 D 20JR	F	"
80	Y112 Z 17B3 M LL292BM2 X C4		
	X C4 D LY4 X Y4RR	F	"
81	Y113 Z LY111 D L3J X CI21 X		
	Y112RR S LY103 D LCI21 X 2B4RR	F	"
82	JUMP TO 88 IF CI21 W Y108	F	"
83	I19 Z I19 S 1	F	"
84	I20 Z I20 S 1	F	"
85	I21 Z I21 S 1	F	"
86	I22 Z I22 S 1	F	"
87	JUMP TO 3	F	"
88	JUMP TO 94 IF 1J W Y113	F	"
89	I19 Z I19 S 1	F	"
90	I20 Z I20 S 1	F	"
91	I21 Z I21 S 1	F	"
92	I22 Z I22 S 1	F	"

			Flow diagram box
93	JUMP TO 3	F	Q
94	Y114 Z Y20 D Y73	F	"
95	Y115 Z Y104 S Y105 S Y106	F	"
96	Y116 Z C4 Y72 D 60J	F	"
97	Y117 Z LC5 X Y50 D Y1R S LCI10		
	X Y12 D 2JR	F	"
98	Y118 Z LY114 S Y115 S Y116		
	S Y117R D Y107	F	"
99	Y119 Z Y50 S LY25 S LCI5 X		
	40J X Y12RR	F	"
100	Y120 Z LC5 X Y119 D Y1R S		
	LCI10 X Y12 D 2JR	F	"
101	Y121 Z Y111 S Y120 S Y120 S		
	Y117 S LC4 X Y72 D 20JR	F	"
102	Y122 Z 17B3 M LL292BM2 X C5		
	X C5R D LY4 X Y4RR	F	"
103	Y123 Z LY121 D L3J X CI21 X		
	Y122RR S LY114 D LCI21 X 2B4RR	F	"
104	JUMP TO 110 IF CI21 W Y118	F	"
105	I19 Z I19 S L	F	"
106	I20 Z I20 S 1	F	"
107	I21 Z I21 S 1	F	"
108	I22 Z I22 S 1	F	"
109	JUMP TO 3	F	"
110	JUMP TO 116 IF 1J W Y123	F	"

			Flow diagram box
111	I19 Z I19 S 1	F	Q
112	I20 Z I20 S 1	F	"
113	I21 Z I21 S 1	F	"
114	I22 Z I22 S 1	F	"
115	JUMP TO 3	F	"
116	Y124 Z LLC6 X 6BM1 X CI18R X LY13 S Y4RR S L3J X CI6 X LC1 S C2 S C3RR S L3J X CI22 X LC4 S C5RR	F	R
117	JUMP TO 1	FF	

APPENDIX D

KEY LIST OF VARIABLES FOR RUNCIBLE PROGRAM

KEY LIST OF VARIABLES FOR RUNCIBLE PROGRAM

In the key list which follows the basic data must be entered in the program in a logical sequence. For example, C11, C21, C31, and C41 are values which pertain to the same size of wire rope.

Y1	Inner anchor spacing	ft
Y2	Outer anchor from inner anchor	ft
Y3	Y1 plus Y2	ft
Y4	Leg spacing	ft
Y5	Temporary storage	
Y6	Required area for diagonal	sq in
Y7	Wind force per unit length of guy	lbs/ft
Y8	Length guy A	ft
Y9	Length guy B	ft
Y10	Length guy C	ft
Y11	Length guy D	ft
Y12	Length guy E	ft
Y13	Length of diagonal	ft
Y14	Wind load per ft, C1 & C2	lbs/ft
Y15	Wind load per ft, C3 & C4	lbs/ft
Y16	Wind load per ft, C5	lbs/ft
Y17	Bending moment at B	lb ft
Y18	Bending moment at C	lb ft
Y19	Bending moment at D	lb ft
Y20	Bending moment at E	lb ft
Y21	Reaction at A	lbs

Y22	Reaction at B	lbs
Y23	Reaction at C	lbs
Y24	Reaction at D	lbs
Y25	Reaction at E	lbs
Y26	Required mast movement at A	ft
Y27	Required mast movement at B	ft
Y28	Required mast movement at C	ft
Y29	Required mast movement at D	ft
Y30	Required mast movement at E	ft
Y31	Fixed end moment A-B	lb ft
Y32	Fixed end moment B-C	lb ft
Y33	Fixed end moment C-D	lb ft
Y34	Fixed end moment D-E	lb ft
Y35	Fixed end moment E-F	lb ft
Y36	Actual mast movement at A	ft
Y37	Actual mast movement at B	ft
Y38	Actual mast movement at C	ft
Y39	Actual mast movement at D	ft
Y40	Actual mast movement at E	ft
Y41	Initial sag A	ft
Y42	Initial sag B	ft
Y43	Initial sag C	ft
Y44	Initial sag D	ft
Y45	Initial sag E	ft
Y46	Horizontal component of guy force in leeward guy A	lbs

Y47	Horizontal component of guy force in leeward guy B	lbs
Y48	Horizontal component of guy force in leeward guy C	lbs
Y49	Horizontal component of guy force in leeward guy D	lbs
Y50	Horizontal component of guy force in leeward guy E	lbs
Y51	Horizontal component of maximum tension A	lbs
Y52	Horizontal component of maximum tension B	lbs
Y53	Horizontal component of maximum tension C	lbs
Y54	Horizontal component of maximum tension D	lbs
Y55	Horizontal component of maximum tension E	lbs
Y56	Vertical component of maximum tension A	lbs
Y57	Vertical component of maximum tension B	lbs
Y58	Vertical component of maximum tension C	lbs
Y59	Vertical component of maximum tension D	lbs

Y60	Vertical component of maximum tension E	lbs
Y61	Maximum tension guy A	lbs
Y62	Maximum tension guy B	lbs
Y63	Maximum tension guy C	lbs
Y64	Maximum tension guy D	lbs
Y65	Maximum tension guy E	lbs
Y66	Safety factor A	
Y67	Safety factor B	
Y68	Safety factor C	
Y69	Safety factor D	
Y70	Safety factor E	
Y71	Dead load, C1, C2, C3	lbs/20 ft
Y72	Dead load, C4, C5	lbs/20 ft
Y73	Effective depth of mast	ft
Y74	Maximum compression in one leg due to wind A	lbs
Y75	Vertical component of guy tension in leeward guy A	lbs
Y76	Allowable stress per leg	psi
Y77	Required area per leg	sq in
Y78	Horizontal component of guy tension in windward guy A	lbs
Y79	Vertical component A	lbs
Y80	Total compression in mast at A	lbs
Y81	Allowable mast stress	psi

Y82	Specification check A	
Y83	Maximum compression in one leg due to wind B	lbs
Y84	Dead load, one leg, A	lbs
Y85	Vertical component of guy tension in leeward guy B	lbs
Y86	Dead load, one leg, A-B	lbs
Y87	Required area per leg	sq in
Y88	Horizontal component of guy tension in windward guy B	lbs
Y89	Vertical component B	lbs
Y90	Total compression in mast at B	lbs
Y91	Allowable stress in mast at B	psi
Y92	Specification check B	
Y93	Maximum compression in one leg due to wind C	lbs
Y94	Dead load, one leg, B	lbs
Y95	Dead load, one leg, B-C	lbs
Y96	Vertical component of guy tension in leeward guy C	lbs
Y97	Required area per leg	sq in
Y98	Horizontal component of guy tension in windward guy C	lbs
Y99	Vertical component C	lbs
Y100	Total compression in mast at C	lbs
Y101	Allowable stress in mast at C	psi
Y102	Specification check	

Y103	Maximum compression in one leg due to wind D	lbs
Y104	Dead load, one leg, C	lbs
Y105	Dead load, one leg, C-D	lbs
Y106	Vertical component of guy tension in leeward guy D	lbs
Y107	Allowable stress in leg	psi
Y108	Required area per leg	sq in
Y109	Horizontal component of guy tension in windward guy D	lbs
Y110	Vertical component D	lbs
Y111	Total compression in mast at D	lbs
Y112	Allowable stress in mast at D	psi
Y113	Specification check	
Y114	Maximum compression in one leg due to wind E	lbs
Y115	Dead load, one leg, D	lbs
Y116	Dead load, one leg, D-E	lbs
Y117	Vertical component of guy tension in leeward guy E	lbs
Y118	Required area per leg	sq in
Y119	Horizontal component of guy tension in windward guy E	lbs
Y120	Vertical component E	lbs
Y121	Total compression in mast at E	lbs
Y122	Allowable stress in mast at E	psi

Y123	Specification check	
Y124	Total weight of mast	lbs
Y125	Assumed diameter of diagonal	ft
Y126	Assumed diameter of legs	ft
Y127	Bending moment at base of antenna	lb ft
Y128	Shear at base of antenna	lbs
Y129	Weight of antenna	lbs
C1	A-B	ft
C2	B-C	ft
C3	C-D	ft
C4	D-E	ft
C5	E-F	ft
C11-C20	Wire rope diameter	in
C21-C30	Wire rope area	sq in
C31-C40	Wire rope breaking load	lbs
C41-C50	Wire rope weight	lbs/ft
C51-C71	Pipe radius of gyration	in
C72-C92	Pipe diameter	ft
C93-C113	Pipe area	sq in
C114-C134	Pipe weight	lbs/ft
I3	Pipe "r" legs C1-C3	in
I4	Pipe "d" legs C1-C3	ft
I5	Pipe "A" legs C1-C3	sq in
I6	Pipe weight legs C1-C3	lbs/ft

I7	Wire rope "d"	ft
I8	Wire rope "A"	sq in
I9	Wire rope breaking load	lbs
I10	Wire rope weight	lbs/ft
I11	Top guy "d"	in
I12	Top guy "A"	sq in
I13	Top guy breaking load	lbs
I14	Top guy weight	lbs/ft
I15	Diagonal "r"	in
I16	Diagonal "d"	ft
I17	Diagonal "A"	sq in
I18	Diagonal weight	lbs/ft
I19	Pipe "r" legs C4-C5	in
I20	Pipe "d" legs C4-C5	ft
I21	Pipe "A" legs C4-C5	sq in
I22	Pipe weight legs C4-C5	lbs/ft

APPENDIX E

DESIGN EXAMPLE ABSTRACTED FROM THE COMPUTER STUDY

DESIGN EXAMPLE ABSTRACTED FROM THE COMPUTER STUDY

The design procedure employed in this investigation will be demonstrated in the following design example taken from the computer program. This particular configuration was that of a guyed aerial tower 500 feet high, with five sets of guys. The guy anchors were 240 and 500 feet from the base of the mast. Guys were attached to the mast at levels 100, 200, 300, 400, and 500 feet above the base.

The mast was designed to support a standard six-bay antenna under the action of a forty psf wind. The weight of the antenna was 18,000 pounds, the design bending moment was 275,000 pound-feet, and the design shear was 7,000 pounds. The total height of the mast plus antenna was 603 feet.

The assumption was made that from ground level to an elevation of 100 feet the mast would resist a horizontal wind pressure of 40 psf on flat surfaces (with proper allowance for shape factor to other shapes). From the 100 foot level to the 300 foot level a 45 psf wind load was assumed, and from an elevation of 300 feet to an elevation of 500 feet a 50 psf wind pressure was used (3).

To calculate the wind loads the diagonal members were assumed to be 0.198 feet in diameter, and the legs were assumed to be 0.375 feet in diameter. These dimensions were assumed to be constant over the length of the mast.

The mast was triangular in cross-section with the legs spaced five feet center-to-center. The wind pressure was applied to one and one-half times the normal projected area of all members in one face (2). Starting from the bottom of the tower, the wind loads were 73.6, 82.8, and 92.1 pounds per linear foot of tower.

The horizontal reactions were found by considering the mast as a continuous beam over unyielding supports, with the computation performed using moment - distribution with constant I for all spans, and with no axial load effect.

A check of this case using moment - distribution factors and carry-over factors modified to account for the axial load and changing moment of inertia as suggested by Niles and Newell (6), shows that the final moments differ by a negligible amount. The L/j ratios, Figure 3, fall in the range 0.56 to 0.81. The curves for stiffness factor coefficient and carry-over factor vary only slightly in this range; the effect on the distribution factors and carry-over factors is negligible.

The reactions were (Figure 1)

$$R_a = 13{,}100 \text{ lbs}$$
$$R_b = 9{,}900 \text{ ''}$$
$$R_c = 8{,}000 \text{ ''}$$
$$R_d = 8{,}200 \text{ ''}$$
$$R_e = 8{,}800 \text{ ''}$$

with guy level "a" at the top and reading down.

The bending moments from the moment distribution solution were

$$M_a = 275{,}000 \text{ lb-ft}$$
$$M_b = 128{,}400 \text{ ''}$$
$$M_c = 61{,}700 \text{ ''}$$

$$M_d = 68,300 \text{ lb ft}$$
$$M_e = 81,500 \text{ "}$$

The mast movement at each guy level was calculated from Equation 59

$$d = 5(R + pL)\frac{L}{3AE}$$

Where R was the reaction, p the wind force per unit length of guy, L the length of the guy, A its cross-sectional area, and E the modulus of elasticity of the guy.

At the 500 foot level the movement "d" using 3/4 inch galvanized bridge strand was 2.07 feet. The mast movement required at the other levels was calculated by using similar triangles; in order for the mast to remain straight the following values were required

$$d_b = 1.65 \text{ ft}$$
$$d_c = 1.24 \text{ "}$$
$$d_d = 0.83 \text{ "}$$
$$d_e = 0.41 \text{ "}$$

The commercial sizes of guy strand which most "nearly" produced straight line mast deflection were 11/16, 11/16, 5/8, and 11/16 beginning at level b and moving down. The exact movement needed could have been obtained by adjusting the lengths of the guys; such a step was unnecessary for the investigation conducted in the study since in theory the guy area could be evaluated at any required magnitude. Straight-line deflection of the points of attachment of the guys to the mast is assumed throughout the study.

An initial tension of 8,000 pounds was assumed for the force in the guylines. The initial sag is calculated from Equation 46 as follows:

$$\Delta = \frac{wLa}{8H}$$

where w is the weight of the guy in pounds per foot, L is the length of the guy, "a" is the distance from the base of the mast to the guy anchor, and H is the horizontal component of the initial tension.

The horizontal component H_c on the leeward guy under full wind load was calculated using Equation 57

$$H_c = \frac{wLa}{8K\Delta i}$$

The maximum horizontal component in the worst loaded guy at each level was calculated from the Equation (Figure 17)

$$H = H_c + H_w$$

The maximum horizontal components were

$$H_a = 17,250 \text{ lbs}$$
$$H_b = 13,200 \text{ "}$$
$$H_c = 10,950 \text{ "}$$
$$H_d = 10,400 \text{ "}$$

$$H_e = 11,100 \text{ lbs}$$

The vertical component at the mast in the worst loaded guy at each level was calculated from Equation 47, where h was the height above ground of the point of guy attachment to the mast.

These were

$$V_a = 17,700 \text{ lbs}$$
$$V_b = 10,900 \text{ "}$$
$$V_c = 6,800 \text{ "}$$
$$V_d = 4,300 \text{ "}$$
$$V_e = 2,350 \text{ "}$$

The total maximum guy force at the mast was calculated using the Pythagorean theorem, and these values were

$$T_a = 24,700 \text{ lbs}$$
$$T_b = 17,100 \text{ "}$$
$$T_c = 12,900 \text{ "}$$
$$T_d = 11,300 \text{ "}$$
$$T_e = 11,300 \text{ "}$$

The mast was checked against two criteria. Each individual leg member was checked as a column with regard to its maximum load and the three-leg mast was considered as a column between guy levels by using the AISC interaction.

The moment at the top of the mast was 275,000 pound feet. The maximum compression in one leg due to the moment was found by summing moments around an axis through the other two legs and was

$$C_a = \frac{275{,}000}{4.33} = 63{,}510 \text{ lbs.}$$

The dead load at this level was 1/3 of the weight of the antenna or 6,000 pounds. The vertical component of the guy tension was added to the compression due to bending moment and the dead load. The resulting compression force in the leeward leg was 70,100 pounds.

Five inch standard pipe was assumed for the legs at this level. The allowable stress was computed from the equation

$$S = 17{,}000 - 0.485\left(\frac{L}{r}\right)^2$$

The area furnished by the pipe was 4.3 square inches.

The mast was checked as a column from A to B (Figure 1). The radius of gyration for a triangular section may be computed by multiplying the leg spacing by 0.408. In this case the radius of gyration was 2.04 feet. The allowable stress for the mast as a column was computed in the same manner as the allowable stress for a leg. The critical wind direction will exist when $\sin \phi$ (Figure 16) equals one-half, and the horizontal component of the guy force is, by inspection of the figure

$$H_A = H_c + F$$

The two windward guys carry equal loads. The vertical component in each was 15,462 pounds.

The total compression in the mast at the top level consisted of the vertical components in all three guys plus the weight of the antenna; this amount was 49,535 pounds. This must satisfy the criteria (RETMA TR 119, Specifications For Guyed Aerial Towers) that

$$\frac{f_a}{F_a} + \frac{f_b}{F_b} < 1 \qquad (7)$$

The assumed size (5 inch) was satisfactory.

The mast was checked at each of the other levels in the same fashion as above. Finally, the diagonal members were designed to carry the maximum shear in the mast, and the mast weight was computed. This completed the tower design for one combination of assumed conditions.

APPENDIX F

OUTPUT DATA FROM COMPUTER PROGRAM

Table 1

Tower Data For Figure 21

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	34,275	a-b	69,824	5 EH
	b	11/16	22,558	b-c	114,799	"
A	c	5/8	12,718	c-d	141,824	"
	d	5/8	9,697	d-e	176,953	3 DEH
	e	5/8	8,223	e-f	196,534	"
		Mast Weight 41.50 kips		Leg Spacing 4 ft		
	a	3/4	34,925	a-b	70,793	3 DEH
	b	11/16	23,625	b-c	116,825	"
A	c	5/8	13,446	c-d	144,354	"
	d	5/8	10,189	d-e	180,394	"
	e	5/8	8,666	e-f	200,860	"
		Mast Weight 41.08 kips		Leg Spacing 5 ft		
	a	3/4	35,604	a-b	71,804	5
	b	11/16	24,738	b-c	118,288	"
A	c	5/8	14,207	c-d	145,794	"
	d	5/8	10,703	d-e	182,283	3 DEH
	e	5/8	9,238	e-f	203,673	"
		Mast Weight 38.95 kips		Leg Spacing 6 ft		

Table 1 (Continued)

Tower Data For Figure 21

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	33,603	a-b	68,824	6
	b	11/16	22,165	b-c	111,822	"
B	c	5/8	13,444	c-d	139,405	"
	d	5/8	9,986	d-e	175,949	3 DEH
	e	5/8	9,357	e-f	199,543	"
		Mast Weight 39.63 kips		Leg Spacing 4 ft		
	a	3/4	34,199	a-b	69,712	3 DEH
	b	11/16	23,204	b-c	114,424	"
B	c	5/8	14,205	c-d	143,176	"
	d	5/8	10,488	d-e	181,289	"
	e	5/8	9,863	e-f	205,969	"
		Mast Weight 41.08 kips		Leg Spacing 5 ft		
	a	3/4	34,821	a-b	70,636	5
	b	11/16	24,288	b-c	115,859	"
B	c	5/8	15,019	c-d	144,657	"
	d	5/8	11,013	d-e	183,448	3 DEH
	e	5/8	10,391	e-f	209,261	"
		Mast Weight 39.19 kips		Leg Spacing 6 ft		

Table 1 (Continued)

Tower Data For Figure 21

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	32,422	a-b	67,065	6
	b	5/8	20,234	b-c	106,144	"
C	c	5/8	13,872	c-d	134,106	"
	d	5/8	11,552	d-e	178,314	5 EH
	e	5/8	10,532	e-f	206,958	"
		Mast Weight 40.93 kips		Leg Spacing 4 ft		
	a	3/4	32,908	a-b	67,789	3 DEH
	b	5/8	21,157	b-c	108,399	"
C	c	5/8	14,668	c-d	137,588	"
	d	5/8	12,141	d-e	183,748	"
	e	5/8	11,104	e-f	213,039	"
		Mast Weight 41.08 kips		Leg Spacing 5 ft		
	a	3/4	33,415	a-b	68,544	5
	b	11/16	22,368	b-c	109,738	"
C	c	5/8	15,499	c-d	139,141	"
	d	5/8	12,756	d-e	186,270	3 DEH
	e	5/8	11,702	e-f	216,924	"
		Mast Weight 39.42 kips		Leg Spacing 6 ft		

Table 1 (Continued)

Tower Data For Figure 21

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	33,964	a-b	69,361	6
	b	5/8	19,873	b-c	109,502	"
D	c	5/8	12,745	c-d	133,988	"
	d	5/8	11,321	d-e	177,262	5 EH
	e	5/8	11,829	e-f	210,880	"
		Mast Weight 41.04 kips		Leg Spacing 4 ft		
	a	3/4	34,580	a-b	70,279	3 DEH
	b	5/8	20,762	b-c	111,931	"
D	c	5/8	13,503	c-d	137,547	"
	d	5/8	11,770	d-e	182,746	5 EH
	e	5/8	12,474	e-f	217,921	"
		Mast Weight 42.53 kips		Leg Spacing 5 ft		
	a	3/4	35,223	a-b	71,237	5
	b	5/8	21,691	b-c	113,186	"
D	c	5/8	14,294	c-d	139,127	"
	d	5/8	12,355	d-e	185,481	6
	e	5/8	13,147	e-f	221,684	"
		Mast Weight 39.92 kips		Leg Spacing 6 ft		

Table 1 (Continued)

Tower Data For Figure 21

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	31,144	a-b	65,161	6
	b	5/8	18,034	b-c	97,835	"
F	c	5/8	16,046	c-d	129,673	"
	d	5/8	13,705	d-e	185,102	4 DEH
	e	5/8	12,914	e-f	226,035	"
		Mast Weight 46.01 kips		Leg Spacing 4 ft		
	a	3/4	31,386	a-b	65,522	3 DEH
	b	5/8	18,809	b-c	99,458	"
F	c	5/8	16,961	c-d	132,736	"
	d	5/8	14,407	d-e	190,697	3½ DEH
	e	5/8	13,619	e-f	231,744	"
		Mast Weight 44.16 kips		Leg Spacing 5 ft		
	a	3/4	31,640	a-b	65,899	5
	b	5/8	19,618	b-c	100,510	"
F	c	5/8	17,915	c-d	134,224	"
	d	5/8	15,139	d-e	193,762	3½ DEH
	e	5/8	14,354	e-f	236,688	"
		Mast Weight 42.97 kips		Leg Spacing 6 ft		

Table 2

Tower Data For Figure 22

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	28,542	a-b	57,577	6
	b	11/16	19,619	b-c	94,666	"
A	c	5/8	11,696	c-d	117,792	"
	d	5/8	9,209	d-e	152,379	4 EH
	e	5/8	8,100	e-f	171,095	"
		Mast Weight 37.93 kips		Leg Spacing 4 ft		
	a	3/4	29,078	a-b	58,304	3 DEH
	b	11/16	20,535	b-c	96,795	"
A	c	5/8	12,353	c-d	120,817	"
	d	5/8	9,677	d-e	156,856	5
	e	5/8	8,536	e-f	176,372	"
		Mast Weight 39.18 kips		Leg Spacing 5 ft		
	a	3/4	29,637	a-b	59,062	5
	b	11/16	21,489	b-c	97,631	"
A	c	5/8	13,038	c-d	121,413	"
	d	5/8	10,165	d-e	157,903	"
	e	5/8	8,992	e-f	178,342	"
		Mast Weight 37.05 kips		Leg Spacing 6 ft		

Table 2 (Continued)

Tower Data For Figure 22

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
			Leg Spacing 4 ft			
B	With 3/4 inch top guys, no commercial size of wire rope was available which would control the bending of the mast within the limit set without adjusting the length of the guys.					
	a	3/4	28,480	a-b	57,493	3 DEH
	b	11/16	20,099	b-c	94,731	"
B	c	5/8	12,982	c-d	119,676	"
	d	5/8	9,856	d-e	157,788	"
	e	5/8	9,680	e-f	182,469	"
		Mast Weight 41.08 kips			Leg Spacing 5 ft	
	a	3/4	28,992	a-b	58,187	5
	b	11/16	21,025	b-c	95,565	"
B	c	11/16	13,878	c-d	120,353	"
	d	5/8	10,350	d-e	159,143	3 DEH
	e	5/8	10,199	e-f	184,956	"
		Mast Weight 39.19 kips			Leg Spacing 6 ft	

Table 2 (Continued)

Tower Data For Figure 22

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	27,016	a-b	55,507	6
	b	5/8	17,413	b-c	87,933	"
C	c	5/8	12,497	c-d	111,972	"
	d	5/8	10,740	d-e	156,180	3 DEH
	e	5/8	10,295	e-f	184,164	"
		Mast Weight 39.61 kips		Leg Spacing 4 ft		
	a	3/4	27,416	a-b	56,050	4 EH
	b	11/16	18,432	b-c	86,645	"
C	c	5/8	13,201	c-d	112,586	"
	d	5/8	11,288	d-e	157,666	3 DEH
	e	5/8	10,855	e-f	186,957	"
		Mast Weight 37.84 kips		Leg Spacing 5 ft		
	a	3/4	27,834	a-b	56,617	5
	b	11/16	19,249	b-c	90,487	"
C	c	5/8	13,935	c-d	115,467	"
	d	5/8	11,860	d-e	162,596	3 DEH
	e	5/8	11,439	e-f	193,250	"
		Mast Weight 39.42 kips		Leg Spacing 6 ft		

Table 2 (Continued)

Tower Data For Figure 22

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
			Leg Spacing 4 ft			
D	With 3/4 inch top guys, no commercial size of wire rope was available which would control the bending of the mast within the limit set without adjusting the length of the guys.					
			Leg Spacing 5 ft			
D	With 3/4 inch top guys, no commercial size of wire rope was available which would control the bending of the mast within the limit set without adjusting the length of the guys.					
			Leg Spacing 6 ft			
D	With 3/4 inch top guys, no commercial size of wire tope was available which would control the bending of the mast within the limit set without adjusting the length of the guys.					

Table 2 (Continued)

Tower Data For Figure 22

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	26,234	a-b	54,446	6
	b	5/8	16,414	b-c	84,042	"
E	c	5/8	13,305	c-d	109,499	"
	d	5/8	11,592	d-e	159,153	5 EH
	e	5/8	11,392	e-f	192,547	"
		Mast Weight 41.04 kips			Leg Spacing 4 ft	
	a	3/4	26,537	a-b	54,857	4 EH
	b	5/8	17,132	b-c	84,692	"
E	c	5/8	14,053	c-d	110,129	"
	d	5/8	12,185	d-e	160,936	3 DEH
	e	5/8	12,013	e-f	195,149	"
		Mast Weight 38.06 kips			Leg Spacing 5 ft	
	a	3/4	26,853	a-b	55,286	5
	b	5/8	17,881	b-c	86,282	"
E	c	11/16	15,029	c-d	112,872	"
	d	5/8	12,804	d-e	166,022	3 DEH
	e	5/8	12,661	e-f	201,846	"
		Mast Weight 39.66 kips			Leg Spacing 6 ft	

Table 2 (Continued)

Tower Data For Figure 22

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
F	a	3/4	25,963	a-b	54,079	6
	b	5/8	15,350	b-c	80,670	"
	c	5/8	14,172	c-d	107,636	"
	d	5/8	12,474	d-e	163,066	$3\frac{1}{2}$ DEH
	e	5/8	12,513	e-f	202,310	"
		Mast Weight 42.64 kips			Leg Spacing 4 ft	
F	a	3/4	26,163	a-b	54,350	5
	b	5/8	15,999	b-c	81,212	"
	c	11/16	15,172	c-d	108,168	"
	d	5/8	13,114	d-e	164,942	5 EH
	e	5/8	13,197	e-f	205,244	"
		Mast Weight 39.58 kips			Leg Spacing 5 ft	
F	a	3/4	26,371	a-b	54,633	5
	b	5/8	16,676	b-c	82,594	"
	c	11/16	16,001	c-d	110,862	"
	d	5/8	13,781	d-e	170,400	5 EH
	e	5/8	13,910	e-f	212,581	"
		Mast Weight 41.48 kips			Leg Spacing 6 ft	

Table 3

Tower Data For Figure 23

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
Leg Spacing 4 ft						
A	With 3/4 inch top guys, no commercial size of wire rope was available which would control the bending of the mast within the limit set without adjusting the length of the guys.					
Leg Spacing 5 ft						
A	With 3/4 inch top guys, no commercial size of wire rope was available which would control the bending of the mast within the limit set without adjusting the length of the guys.					
Leg Spacing 6 ft						
A	With 3/4 inch top guys, no commercial size of wire rope was available which would control the bending of the mast within the limit set without adjusting the length of the guys.					

Table 3 (Continued)

Tower Data For Figure 23

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
			Leg Spacing 4 ft			
B	With 3/4 inch top guys, no commercial size of wire rope was available which would control the bending of the mast within the limit set without adjusting the length of the guys.					
			Leg Spacing 5 ft			
B	With 3/4 inch top guys, no commercial size of wire rope was available which would control the bending of the mast within the limit set without adjusting the length of the guys.					
			Leg Spacing 6 ft			
B	With 3/4 inch top guys, no commercial size of wire rope was available which would control the bending of the mast within the limit set without adjusting the length of the guys.					

Table 3 (Continued)

Tower Data For Figure 23

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
			Leg Spacing 4 ft			
C	With 3/4 inch top guys, no commercial size of wire rope was available which would control the bending of the mast within the limit set without adjusting the length of the guys.					
			Leg Spacing 5 ft			
C	With 3/4 inch top guys, no commercial size of wire rope was available which would control the bending of the mast within the limit set without adjusting the length of the guys.					
			Leg Spacing 6 ft			
C	With 3/4 inch top guys, no commercial size of wire rope was available which would control the bending of the mast within the limit set without adjusting the length of the guys.					

Table 3 (Continued)

Tower Data For Figure 23

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
			Leg Spacing 4 ft			
D	With 3/4 inch top guys, no commercial size of wire rope was available which would control the bending of the mast within the limit set without adjusting the length of the guys.					
			Leg Spacing 5 ft			
D	With 3/4 inch top guys, no commercial size of wire rope was available which would control the bending of the mast within the limit set without adjusting the length of the guys.					
			Leg Spacing 6 ft			
D	With 3/4 inch top guys, no commercial size of wire rope was available which would control the bending of the mast within the limit set without adjusting the length of the guys.					

Table 3 (Continued)

Tower Data For Figure 23

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
			Leg Spacing 4 ft			
E	With 3/4 inch top guys, no commercial size of wire rope was available which would control the bending of the mast within the limit set without adjusting the length of the guys.					
	a	3/4	23,749	a-b	48,258	5
	b	5/8	15,673	b-c	73,963	"
E	c	11/16	13,471	c-d	96,593	"
	d	5/8	11,659	d-e	147,292	3 DEH
	e	5/8	11,857	e-f	181,505	"
		Mast Weight 37.76 kips			Leg Spacing 5 ft	
	a	3/4	24,028	a-b	48,502	5
	b	11/16	16,596	b-c	75,395	"
E	c	11/16	14,194	c-d	99,083	"
	d	5/8	12,251	d-e	152,233	3 DEH
	e	5/8	12,497	e-f	188,051	"
		Mast Weight 39.66 kips			Leg Spacing 6 ft	

Table 3 (Continued)

Tower Data For Figure 23

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
			Leg Spacing 4 ft			
F	With 3/4 inch top guys, no commercial size of wire rope was available which would control the bending of the mast within the limit set without adjusting the length of the guys.					
	a	3/4	23,418	a-b	47,752	5
	b	5/8	14,579	b-c	70,874	"
F	c	11/16	14,241	c-d	94,789	"
	d	5/8	12,467	d-e	151,562	6
	e	5/8	12,996	e-f	191,212	"
		Mast Weight 38.27 kips			Leg Spacing 5 ft	
	a	3/4	23,603	a-b	47,979	5
	b	5/8	15,186	b-c	72,025	"
F	c	11/16	15,005	c-d	97,066	"
	d	5/8	13,102	d-e	156,604	3 DEH
	e	5/8	13,698	e-f	197,993	"
		Mast Weight 39.90 kips			Leg Spacing 6 ft	

Table 1 (Continued)

Tower Data For Figure 21

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	31,473	a-b	65,651	6
	b	5/8	19,185	b-c	101,644	"
E	c	5/8	14,920	c-d	131,482	"
	d	5/8	12,602	d-e	181,136	$3\frac{1}{2}$ DEH
	e	5/8	11,704	e-f	215,214	"
		Mast Weight 42.40 kips			Leg Spacing 4 ft	
	a	3/4	31,840	a-b	66,198	3 DEH
	b	5/8	20,037	b-c	103,595	"
E	c	5/8	15,774	c-d	134,764	"
	d	5/8	13,247	d-e	186,651	5 EH
	e	5/8	12,342	e-f	221,590	"
		Mast Weight 42.53 kips			Leg Spacing 5 ft	
	a	3/4	32,224	a-b	66,770	5
	b	5/8	20,926	b-c	104,778	"
E	c	5/8	16,664	c-d	136,268	"
	d	5/8	13,919	d-e	189,418	5 EH
	e	5/8	13,007	e-f	225,968	"
		Mast Weight 41.11 kips			Leg Spacing 6 ft	

Table 4

Tower Data For Figure 24

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	28,647	a-b	57,882	6
	b	11/16	19,702	b-c	95,079	"
A	c	5/8	11,767	c-d	118,320	"
	d	5/8	9,419	d-e	143,530	5
	e	5/8	8,337	e-f	157,883	"
		Mast Weight 37.75 kips		Leg Spacing 4 ft		
	a	3/4	29,181	a-b	58,547	3 DEH
	b	11/16	20,615	b-c	97,202	"
A	c	5/8	12,421	c-d	121,335	"
	d	5/8	9,884	d-e	147,497	$2\frac{1}{2}$ DEH
	e	5/8	8,771	e-f	162,268	"
		Mast Weight 38.74 kips		Leg Spacing 5 ft		
	a	3/4	29,739	a-b	59,302	5
	b	11/16	21,568	b-c	98,031	"
A	c	5/8	13,105	c-d	121,922	"
	d	5/8	10,370	d-e	148,011	$2\frac{1}{2}$ DEH
	e	5/8	9,225	e-f	163,448	"
		Mast Weight 36.61 kips		Leg Spacing 6 ft		

Table 4 (Continued)

Tower Data For Figure 24

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	28,095	a-b	57,074	6
	b	11/16	19,296	b-c	93,236	"
B	c	5/8	12,360	c-d	117,243	"
	d	5/8	9,588	d-e	143,211	4 EH
	e	5/8	9,412	e-f	160,348	"
		Mast Weight 37.69 kips		Leg Spacing 4 ft		
	a	3/4	28,584	a-b	57,738	3 DEH
	b	11/16	20,182	b-c	95,146	"
B	c	5/8	13,049	c-d	120,205	"
	d	5/8	10,058	d-e	147,182	5
	e	5/8	9,907	e-f	164,993	"
		Mast Weight 38.94 kips		Leg Spacing 5 ft		
	a	3/4	29,095	a-b	58,430	5
	b	11/16	21,106	b-c	95,975	"
B	c	11/16	13,965	c-d	120,908	"
	d	5/8	10,550	d-e	147,979	"
	e	5/8	10,424	e-f	166,595	"
		Mast Weight 37.05		Leg Spacing 6 ft		

Table 4 (Continued)

Tower Data For Figure 24

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	27,124	a-b	55,759	6
	b	5/8	17,481	b-c	88,330	"
C	c	5/8	12,568	c-d	112,497	"
	d	5/8	10,934	d-e	143,426	3 DEH
	e	5/8	10,517	e-f	164,561	"
		Mast Weight 39.61 kips			Leg Spacing 4 ft	
	a	3/4	27,523	a-b	56,300	4 EH
	b	11/16	18,520	b-c	89,082	"
C	c	5/8	13,270	c-d	113,148	"
	d	5/8	11,480	d-e	144,241	3 DEH
	e	5/8	11,075	e-f	166,292	"
		Mast Weight 37.84 kips			Leg Spacing 5 ft	
	a	3/4	27,940	a-b	56,865	5
	b	11/16	19,335	b-c	90,919	"
C	c	5/8	14,003	c-d	116,020	"
	d	5/8	12,050	d-e	148,424	4 EH
	e	5/8	11,657	e-f	170,351	"
		Mast Weight 37.26 kips			Leg Spacing 6 ft	

Table 4 (Continued)

Tower Data For Figure 24

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	28,391	a-b	57,756	6
	b	5/8	17,294	b-c	91,351	"
D	c	5/8	11,575	c-d	112,393	"
	d	5/8	10,503	d-e	141,951	3 DEH
	e	5/8	11,729	e-f	166,415	"
		Mast Weight 39.58 kips			Leg Spacing 4 ft	
	a	3/4	28,898	a-b	58,162	3 DEH
	b	11/16	18,299	b-c	93,322	"
D	c	5/8	12,243	c-d	115,257	"
	d	5/8	11,017	d-e	146,023	"
	e	5/8	12,354	e-f	171,565	"
		Mast Weight 41.08 kips			Leg Spacing 5 ft	
	a	3/4	29,426	a-b	58,878	5
	b	11/16	19,090	b-c	94,015	"
D	c	5/8	12,940	c-d	116,029	"
	d	5/8	11,553	d-e	147,201	3 DEH
	e	5/8	13,008	e-f	173,868	"
		Mast Weight 39.66 kips			Leg Spacing 6 ft	

Table 4 (Continued)

Tower Data For Figure 24

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	26,343	a-b	54,702	6
	b	5/8	16,486	b-c	84,455	"
E	c	5/8	13,376	c-d	110,045	"
	d	5/8	11,779	d-e	144,201	3 DEH
	e	5/8	11,607	e-f	168,534	"
		Mast Weight 39.58 kips			Leg Spacing 4 ft	
	a	3/4	26,645	a-b	55,111	4 EH
	b	5/8	17,203	b-c	85,100	"
E	c	5/8	14,122	c-d	110,666	"
	d	5/8	12,370	d-e	145,151	3 DEH
	e	5/8	12,226	e-f	170,555	"
		Mast Weight 38.06 kips			Leg Spacing 5 ft	
	a	3/4	26,961	a-b	55,539	5
	b	5/8	17,951	b-c	86,685	"
E	c	11/16	15,118	c-d	113,441	"
	d	5/8	12,988	d-e	149,411	3 DEH
	e	5/8	12,872	e-f	175,931	"
		Mast Weight 39.66 kips			Leg Spacing 6 ft	

Table 4 (Continued)

Tower Data For Figure 24

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	26,073	a-b	54,336	6
	b	5/8	15,426	b-c	81,097	"
F	c	5/8	14,242	c-d	108,200	"
	d	5/8	12,656	d-e	145,777	"
	e	5/8	12,722	e-f	173,657	"
		Mast Weight 39.84 kips			Leg Spacing 4 ft	
	a	3/4	26,272	a-b	54,606	5
	b	5/8	16,074	b-c	81,634	"
F	c	11/16	15,263	c-d	108,766	"
	d	5/8	13,293	d-e	146,740	3 DEH
	e	5/8	13,403	e-f	175,716	"
		Mast Weight 37.99 kips			Leg Spacing 5 ft	
	a	3/4	26,480	a-b	54,887	5
	b	5/8	16,749	b-c	83,425	"
F	c	11/16	16,089	c-d	112,177	"
	d	5/8	13,958	d-e	152,168	3 DEH
	e	11/16	14,217	e-f	182,641	"
		Mast Weight 39.90 kips			Leg Spacing 6 ft	

Table 5

Tower Data For Figure 25

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	25,608	a-b	50,520	6
	b	11/16	18,251	b-c	83,496	"
A	c	11/16	11,553	c-d	104,838	"
	d	5/8	9,177	d-e	130,048	$2\frac{1}{2}$ DEH
	e	5/8	8,276	e-f	144,180	"
		Mast Weight 37.31 kips			Leg Spacing 4 ft	
	a	3/4	26,080	a-b	51,100	4 EH
	b	3/4	19,371	b-c	83,921	"
A	c	11/16	12,171	c-d	104,842	"
	d	5/8	9,630	d-e	129,924	$3\frac{1}{2}$ EH
	e	5/8	8,708	e-f	144,408	"
		Mast Weight 34.50 kips			Leg Spacing 5 ft	
	a	3/4	26,573	a-b	51,705	5
	b	3/4	20,241	b-c	85,778	"
A	c	11/16	12,816	c-d	107,514	"
	d	5/8	10,104	d-e	133,603	$3\frac{1}{2}$ DEH
	e	5/8	9,158	e-f	148,754	"
		Mast Weight 36.03 kips			Leg Spacing 6 ft	

Table 5 (Continued)

Tower Data For Figure 25

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	25,120	a-b	49,921	6
	b	11/16	17,830	b-c	81,729	"
B	c	11/16	12,079	c-d	103,776	"
	d	5/8	9,287	d-e	129,745	5
	e	5/8	9,327	e-f	146,785	"
		Mast Weight 37.49 kips		Leg Spacing 4 ft		
	a	3/4	25,553	a-b	50,452	5
	b	11/16	18,637	b-c	81,979	"
B	c	11/16	12,728	c-d	103,528	"
	d	5/8	9,743	d-e	129,436	$2\frac{1}{2}$ DEH
	e	5/8	9,817	e-f	146,999	"
		Mast Weight 34.65 kips		Leg Spacing 5 ft		
	a	3/4	26,004	a-b	51,006	5
	b	3/4	19,770	b-c	83,941	"
B	c	11/16	13,405	c-d	106,466	"
	d	5/8	10,219	d-e	133,537	$2\frac{1}{2}$ DEH
	e	5/8	10,330	e-f	151,904	"
		Mast Weight 36.55 kips		Leg Spacing 6 ft		

Table 5 (Continued)

Tower Data For Figure 25

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	24,262	a-b	48,869	6
	b	11/16	16,324	b-c	77,548	"
C	c	5/8	11,956	c-d	99,393	"
	d	5/8	10,527	d-e	130,322	3 DEH
	e	5/8	10,402	e-f	151,457	"
		Mast Weight 39.61 kips			Leg Spacing 4 ft	
	a	3/4	24,615	a-b	49,302	5
	b	11/16	17,031	b-c	77,808	"
C	c	11/16	12,829	c-d	99,352	"
	d	5/8	11,053	d-e	130,336	"
	e	5/8	10,953	e-f	151,199	"
		Mast Weight 35.14 kips			Leg Spacing 5 ft	
	a	3/4	24,983	a-b	49,754	5
	b	11/16	17,769	b-c	79,440	"
C	c	11/16	13,512	c-d	101,974	"
	d	5/8	11,602	d-e	134,378	"
	e	5/8	11,529	e-f	156,196	"
		Mast Weight 37.05 kips			Leg Spacing 6 ft	

Table 5 (Continued)

Tower Data For Figure 25

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
			Leg Spacing 4 ft			
D	With 3/4 inch top guys, no commercial size of wire rope was available which would control the bending of the mast within the limit set without adjusting the length of the guys.					
			Leg Spacing 5 ft			
D	With 3/4 inch top guys, no commercial size of wire rope was available which would control the bending of the mast within the limit set without adjusting the length of the guys.					
			Leg Spacing 6 ft			
D	With 3/4 inch top guys, no commercial size of wire tope was available which would control the bending of the mast within the limit set without adjusting the length of the guys.					

Table 5 (Continued)

Tower Data For Figure 25

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	23,572	a-b	38,023	6
	b	5/8	15,087	b-c	73,973	"
E	c	11/16	12,858	c-d	97,023	"
	d	5/8	11,270	d-e	131,180	3 DEH
	e	5/8	11,456	e-f	155,513	"
		Mast Weight 39.58 kips			Leg Spacing 4 ft	
	a	3/4	23,839	a-b	48,350	5
	b	5/8	15,732	b-c	74,270	"
E	c	11/16	13,549	c-d	97,026	"
	d	5/8	11,835	d-e	131,403	3 DEH
	e	5/8	12,067	e-f	156,807	"
		Mast Weight 37.76 kips			Leg Spacing 5 ft	
	a	3/4	24,118	a-b	48,692	5
	b	11/16	16,673	b-c	75,734	"
E	c	11/16	14,270	c-d	99,545	"
	d	5/8	12,426	d-e	135,515	4 EH
	e	5/8	12,705	e-f	160,847	"
		Mast Weight 37.28			Leg Spacing 6 ft	

Table 5 (Continued)

Tower Data For Figure 25

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	23,334	a-b	47,730	6
	b	5/8	14,062	b-c	70,875	"
F	c	11/16	13,589	c-d	95,148	"
	d	5/8	12,031	d-e	132,725	3 DEH
	e	5/8	12,527	e-f	160,463	"
		Mast Weight 39.56 kips		Leg Spacing 4 ft		
	a	3/4	23,510	a-b	47,946	5
	b	5/8	14,642	b-c	71,192	"
F	c	11/16	14,318	c-d	95,237	"
	d	5/8	12,637	d-e	133,211	3 DEH
	e	5/8	13,198	e-f	162,186	"
		Mast Weight 37.99 kips		Leg Spacing 5 ft		
	a	3/4	23,693	a-b	48,171	5
	b	5/8	15,247	b-c	72,340	"
F	c	11/16	15,080	c-d	97,508	"
	d	5/8	13,270	d-e	137,257	3 DEH
	e	5/8	13,899	e-f	167,523	"
		Mast Weight 39.90 kips		Leg Spacing 6 ft		

Table 6

Tower Data For Figure 26

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	28,775	a-b	58,124	6
	b	11/16	19,804	b-c	95,588	"
A	c	5/8	11,853	c-d	118,971	"
	d	5/8	9,657	d-e	140,349	$2\frac{1}{2}$ DEH
	e	5/8	8,585	e-f	152,752	"
		Mast Weight 37.31 kips			Leg Spacing 4 ft	
	a	3/4	29,309	a-b	58,845	3 DEH
	b	11/16	20,715	b-c	97,704	"
A	c	5/8	12,506	c-d	121,975	"
	d	5/8	10,120	d-e	144,095	$2\frac{1}{2}$ DEH
	e	5/8	9,017	e-f	157,034	"
		Mast Weight 38.74 kips			Leg Spacing 5 ft	
	a	3/4	29,866	a-b	59,598	5
	b	11/16	21,665	b-c	98,525	"
A	c	5/8	13,187	c-d	122,551	"
	d	5/8	10,604	d-e	144,380	$2\frac{1}{2}$ DEH
	e	5/8	9,468	e-f	157,877	"
		Mast Weight 36.61 kips			Leg Spacing 6 ft	

Table 6 (Continued)

Tower Data For Figure 26

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	28,225	a-b	57,379	6
	b	11/16	19,400	b-c	93,646	"
B	c	5/8	12,446	c-d	117,906	"
	d	5/8	9,823	d-e	139,549	5
	e	5/8	9,654	e-f	154,359	"
		Mast Weight 37.49 kips			Leg Spacing 4 ft	
	a	3/4	28,713	a-b	58,040	3 DEH
	b	11/16	20,283	b-c	96,009	"
B	c	5/8	13,133	c-d	121,461	"
	d	5/8	10,292	d-e	144,045	5
	e	11/16	10,295	e-f	159,690	"
		Mast Weight 38.94 kips			Leg Spacing 5 ft	
	a	3/4	29,223	a-b	58,729	5
	b	11/16	21,206	b-c	96,830	"
B	c	11/16	14,073	c-d	122,197	"
	d	5/8	10,781	d-e	144,632	$2\frac{1}{2}$ DEH
	e	5/8	10,808	e-f	160,693	"
		Mast Weight 36.55 kips			Leg Spacing 6 ft	

Table 6 (Continued)

Tower Data For Figure 26

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	27,256	a-b	56,069	6
	b	5/8	17,565	b-c	89,189	"
C	c	5/8	12,655	c-d	113,793	"
	d	5/8	11,162	d-e	139,459	3 DEH
	e	11/16	10,901	e-f	158,005	"
		Mast Weight 39.61 kips			Leg Spacing 4 ft	
	a	3/4	27,654	a-b	56,608	4 EH
	b	11/16	18,629	b-c	89,992	"
C	c	5/8	13,356	c-d	114,490	"
	d	5/8	11,707	d-e	140,025	5
	e	11/16	11,455	e-f	158,133	"
		Mast Weight 35.47 kips			Leg Spacing 5 ft	
	a	3/4	28,070	a-b	57,170	5
	b	11/16	19,442	b-c	91,821	"
C	c	5/8	14,086	c-d	117,350	"
	d	5/8	12,275	d-e	143,889	"
	e	11/16	12,034	e-f	162,781	"
		Mast Weight 37.05 kips			Leg Spacing 6 ft	

Table 6 (Continued)

Tower Data For Figure 26

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	28,520	a-b	57,778	6
	b	5/8	17,377	b-c	92,175	"
D	c	5/8	11,668	c-d	113,660	"
	d	5/8	10,732	d-e	137,798	3 DEH
	e	11/16	12,106	e-f	159,028	"
		Mast Weight 39.58 kips			Leg Spacing 4 ft	
	a	3/4	29,026	a-b	58,462	3 DEH
	b	11/16	18,406	b-c	94,194	"
D	c	5/8	12,332	c-d	116,567	"
	d	5/8	11,244	d-e	141,614	"
	e	11/16	12,728	e-f	163,719	"
		Mast Weight 41.08 kips			Leg Spacing 5 ft	
	a	3/4	29,553	a-b	59,176	5
	b	11/16	19,195	b-c	94,879	"
D	c	5/8	13,027	c-d	117,327	"
	d	5/8	11,778	d-e	142,469	4 EH
	e	11/16	13,378	e-f	164,400	"
		Mast Weight 37.29 kips			Leg Spacing 6 ft	

Table 6 (Continued)

Tower Data For Figure 26

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	26,477	a-b	55,016	6
	b	5/8	16,575	b-c	85,355	"
E	c	5/8	13,463	c-d	111,403	"
	d	5/8	12,003	d-e	139,397	3 DEH
	e	11/16	11,986	e-f	160,535	"
		Mast Weight 39.58 kips			Leg Spacing 4 ft	
	a	3/4	26,779	a-b	55,424	4 EH
	b	5/8	17,290	b-c	85,994	"
E	c	5/8	14,207	c-d	112,014	"
	d	5/8	12,593	d-e	139,994	3 DEH
	e	11/16	12,601	e-f	162,002	"
		Mast Weight 38.06 kips			Leg Spacing 5 ft	
	a	3/4	27,094	a-b	55,201	5
	b	5/8	18,036	b-c	84,423	"
E	c	11/16	15,228	c-d	113,751	"
	d	5/8	13,208	d-e	145,835	3 DEH
	e	3/4	13,413	e-f	172,012	"
		Mast Weight 39.90 kips			Leg Spacing 6 ft	

Table 6 (Continued)

Tower Data For Figure 26

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	26,208	a-b	54,652	6
	b	5/8	15,520	b-c	82,037	"
F	c	5/8	14,329	b-c	109,621	"
	d	5/8	12,875	c-d	140,080	3 DEH
	e	11/16	13,095	d-e	163,955	"
		Mast Weight 39.56 kips			Leg Spacing 4 ft	
	a	3/4	26,407	a-b	54,921	5
	b	5/8	16,166	b-c	83,052	"
F	c	11/16	15,374	c-d	111,077	"
	d	5/8	13,511	d-e	141,797	3 DEH
	e	3/4	13,944	e-f	166,935	"
		Mast Weight 37.99 kips			Leg Spacing 5 ft	
	a	3/4	26,614	a-b	55,201	5
	b	5/8	16,840	b-c	84,423	"
F	c	11/16	16,198	c-d	113,751	"
	d	5/8	14,174	d-e	145,835	3 DEH
	e	3/4	14,649	e-f	172,012	"
		Mast Weight 39.90 kips			Leg Spacing 6 ft	

Table 7

Tower Data For Figure 27

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	25,715	a-b	50,748	6
	b	11/16	18,337	b-c	83,878	"
A	c	11/16	11,651	c-d	105,356	"
	d	5/8	9,407	d-e	126,733	3½ EH
	e	5/8	8,521	e-f	138,851	"
		Mast Weight 36.74 kips			Leg Spacing 4 ft	
	a	3/4	26,187	a-b	51,326	4 EH
	b	3/4	19,480	b-c	84,342	"
A	c	11/16	12,267	c-d	105,395	"
	d	5/8	9,859	d-e	126,435	3½ EH
	e	5/8	8,950	e-f	139,088	"
		Mast Weight 34.50 kips			Leg Spacing 5 ft	
	a	3/4	26,679	a-b	51,929	5
	b	3/4	20,347	b-c	86,192	"
A	c	11/16	12,910	c-d	108,058	"
	d	5/8	10,331	d-e	129,887	3½ EH
	e	5/8	9,399	e-f	143,099	"
		Mast Weight 36.03 kips			Leg Spacing 6 ft	

Table 7 (Continued)

Tower Data For Figure 27

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	25,228	a-b	50,152	6
	b	11/16	17,918	b-c	82,119	"
B	c	11/16	12,176	c-d	104,305	"
	d	5/8	9,513	d-e	125,948	$2\frac{1}{2}$ DEH
	e	5/8	9,565	e-f	140,510	"
		Mast Weight 37.00 kips		Leg Spacing 4 ft		
	a	3/4	25,660	a-b	50,681	5
	b	11/16	18,723	b-c	82,365	"
B	c	11/16	12,823	c-d	104,048	"
	d	5/8	9,968	d-e	125,397	$3\frac{1}{2}$ EH
	e	5/8	10,054	e-f	140,277	"
		Mast Weight 34.00 kips		Leg Spacing 5 ft		
	a	3/4	26,111	a-b	51,233	5
	b	3/4	19,879	b-c	84,365	"
B	c	11/16	13,498	c-d	107,021	"
	d	5/8	10,442	d-e	129,290	$3\frac{1}{2}$ EH
	e	5/8	10,565	e-f	144,838	"
		Mast Weight 35.91 kips		Leg Spacing 6 ft		

Table 7 (Continued)

Tower Data For Figure 27

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	24,372	a-b	49,103	6
	b	11/16	16,418	b-c	77,959	"
C	c	5/8	12,031	c-d	99,920	"
	d	5/8	10,745	d-e	125,402	5
	e	5/8	10,635	e-f	142,553	"
		Mast Weight 37.23 kips		Leg Spacing 4 ft		
	a	3/4	24,725	a-b	49,535	5
	b	11/16	17,123	b-c	78,582	"
C	c	11/16	12,925	c-d	100,563	"
	d	5/8	11,270	d-e	125,990	$2\frac{1}{2}$ DEH
	e	11/16	11,328	e-f	143,823	"
		Mast Weight 34.59 kips		Leg Spacing 5 ft		
	a	3/4	25,092	a-b	49,985	5
	b	11/16	17,860	b-c	80,209	"
C	c	11/16	13,606	c-d	103,177	"
	d	5/8	11,817	d-e	129,715	$2\frac{1}{2}$ EH
	e	11/16	11,900	e-f	148,331	"
		Mast Weight 36.50 kips		Leg Spacing 6 ft		

Table 7 (Continued)

Tower Data For Figure 27

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	25,490	a-b	50,472	6
	b	11/16	16,324	b-c	81,121	"
D	c	5/8	11,107	c-d	100,455	"
	d	5/8	10,265	d-e	124,594	3 DEH
	e	11/16	11,946	e-f	145,823	"
		Mast Weight 39.58 kips		Leg Spacing 4 ft		
	a	3/4	25,937	a-b	51,019	5
	b	11/16	17,013	b-c	81,262	"
D	c	5/8	11,729	c-d	100,398	"
	d	5/8	10,756	d-e	124,494	"
	e	11/16	12,560	e-f	145,293	"
		Mast Weight 35.14 kips		Leg Spacing 5 ft		
	a	3/4	26,403	a-b	51,591	5
	b	11/16	17,732	b-c	83,043	"
D	c	5/8	12,377	c-d	103,061	"
	d	5/8	11,267	d-e	128,202	"
	e	11/16	13,202	e-f	149,915	"
		Mast Weight 37.05 kips		Leg Spacing 6 ft		

Table 7 (Continued)

Tower Data For Figure 27

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	23,684	a-b	48,261	6
	b	5/8	15,161	b-c	74,742	"
E	c	11/16	12,956	c-d	98,254	"
	d	5/8	11,483	d-e	126,249	3 DEH
	e	11/16	11,827	e-f	147,386	"
		Mast Weight 39.58 kips		Leg Spacing 4 ft		
	a	3/4	23,951	a-b	48,587	5
	b	5/8	15,806	b-c	75,034	"
E	c	11/16	13,645	c-d	98,248	"
	d	5/8	12,047	d-e	126,212	"
	e	11/16	12,435	e-f	146,822	"
		Mast Weight 35.14 kips		Leg Spacing 5 ft		
	a	3/4	24,229	a-b	48,928	5
	b	11/16	16,768	b-c	76,539	"
E	c	11/16	14,363	c-d	100,803	"
	d	5/8	12,636	d-e	129,910	"
	e	11/16	13,069	e-f	151,520	"
		Mast Weight 37.05 kips		Leg Spacing 6 ft		

Table 7 (Continued)

Tower Data For Figure 27

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	23,446	a-b	47,969	6
	b	5/8	14,141	b-c	71,676	"
F	c	11/16	13,686	c-d	96,432	"
	d	5/8	12,239	d-e	126,891	3 DEH
	e	11/16	12,892	e-f	150,766	"
		Mast Weight 39.56 kips			Leg Spacing 4 ft	
	a	3/4	23,622	a-b	48,184	5
	b	5/8	14,720	b-c	71,989	"
F	c	11/16	14,413	c-d	96,513	"
	d	5/8	12,843	d-e	126,973	3 DEH
	e	11/16	13,560	e-f	151,847	"
		Mast Weight 37.99 kips			Leg Spacing 5 ft	
	a	3/4	23,805	a-b	48,409	5
	b	5/8	15,324	b-c	73,604	"
F	c	11/16	15,172	c-d	99,616	"
	d	5/8	13,474	d-e	131,700	3 DEH
	e	3/4	14,422	e-f	147,878	"
		Mast Weight 39.90 kips			Leg Spacing 6 ft	

Table 8

Tower Data For Figure 28

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	24,051	a-b	46,091	6
	b	3/4	17,986	b-c	76,626	"
A	c	11/16	11,596	c-d	96,913	"
	d	5/8	9,471	d-e	116,466	$3\frac{1}{2}$ EH
	e	5/8	8,696	e-f	127,776	"
		Mast Weight 36.74 kips			Leg Spacing 4 ft	
	a	3/4	25,046	a-b	46,571	5
	b	3/4	18,769	b-c	76,949	"
A	c	11/16	12,190	c-d	96,889	"
	d	5/8	9,915	d-e	116,055	$3\frac{1}{2}$ EH
	e	5/8	9,306	e-f	128,048	"
		Mast Weight 34.13 kips			Leg Spacing 5 ft	
	a	3/4	24,937	a-b	47,072	5
	b	3/4	19,587	b-c	78,687	"
A	c	11/16	12,810	c-d	99,471	"
	d	5/8	10,379	d-e	119,428	$3\frac{1}{2}$ EH
	e	11/16	9,748	e-f	131,926	"
		Mast Weight 36.03 kips			Leg Spacing 6 ft	

Table 8 (Continued)

Tower Data For Figure 28

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	23,604	a-b	45,595	6
	b	3/4	17,562	b-c	74,361	"
B	c	11/16	12,078	c-d	96,531	"
	d	5/8	9,542	d-e	116,286	3½ EH
	e	5/8	9,904	e-f	129,686	"
		Mast Weight 36.35 kips		Leg Spacing 4 ft		
	a	3/4	24,462	a-b	46,035	5
	b	3/4	18,318	b-c	75,372	"
B	c	11/16	12,701	c-d	95,949	"
	d	5/8	9,986	d-e	115,296	3½ EH
	e	5/8	10,387	e-f	129,271	"
		Mast Weight 34.00 kips		Leg Spacing 5 ft		
	a	3/4	24,415	a-b	46,494	5
	b	3/4	19,107	b-c	77,017	"
B	c	3/4	13,658	c-d	98,463	"
	d	5/8	10,451	d-e	118,722	3½ EH
	e	11/16	10,891	e-f	133,296	"
		Mast Weight 35.91 kips		Leg Spacing 6 ft		

Table 8 (Continued)

Tower Data For Figure 28

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	22,818	a-b	44,724	6
	b	11/16	15,742	b-c	71,457	"
C	c	11/16	12,099	c-d	92,386	"
	d	5/8	10,707	d-e	115,454	2½ DEH
	e	5/8	10,949	e-f	131,225	"
		Mast Weight 36.68 kips			Leg Spacing 4 ft	
	a	3/4	23,703	a-b	45,083	5
	b	11/16	16,403	b-c	71,510	"
C	c	11/16	12,722	c-d	91,980	"
	d	5/8	11,219	d-e	114,665	2½ DEH
	e	5/8	11,492	e-f	131,107	"
		Mast Weight 34.59 kips			Leg Spacing 5 ft	
	a	3/4	23,479	a-b	45,457	5
	b	11/16	17,093	b-c	73,362	"
C	c	11/16	13,373	c-d	95,067	"
	d	5/8	11,753	d-e	118,934	3½ EH
	e	3/4	12,265	e-f	135,972	"
		Mast Weight 35.78 kips			Leg Spacing 6 ft	

Table 8 (Continued)

Tower Data For Figure 28

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	23,844	a-b	45,862	6
	b	11/16	15,715	b-c	74,116	"
D	c	5/8	10,943	c-d	92,171	"
	d	5/8	10,198	d-e	113,626	5
	e	11/16	12,089	e-f	131,919	"
		Mast Weight 36.97 kips			Leg Spacing 4 ft	
	a	3/4	22,992	a-b	44,296	5
	b	11/16	15,383	b-c	68,806	"
D	c	5/8	13,356	c-d	90,686	"
	d	5/8	11,930	d-e	115,584	$2\frac{1}{2}$ DEH
	e	5/8	12,779	e-f	134,442	"
		Mast Weight 34.54 kips			Leg Spacing 5 ft	
	a	3/4	24,683	a-b	46,791	5
	b	11/16	17,050	b-c	76,018	"
D	c	11/16	12,429	c-d	95,013	"
	d	5/8	11,172	d-e	117,411	$2\frac{1}{2}$ DEH
	e	3/4	13,535	e-f	137,256	"
		Mast Weight 36.44 kips			Leg Spacing 6 ft	

Table 8 (Continued)

Tower Data For Figure 28

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	22,186	a-b	44,024	6
	b	5/8	14,468	b-c	68,568	"
E	c	11/16	12,700	c-d	90,855	"
	d	5/8	11,381	d-e	116,043	4 EH
	e	3/4	12,180	e-f	134,652	"
		Mast Weight 37.21 kips			Leg Spacing 4 ft	
	a	3/4	24,816	a-b	46,318	5
	b	5/8	16,364	b-c	74,461	"
E	c	11/16	11,537	c-d	92,575	"
	d	5/8	10,675	d-e	114,079	$2\frac{1}{2}$ DEH
	e	5/8	12,903	e-f	133,114	"
		Mast Weight 34.54 kips			Leg Spacing 5 ft	
	a	3/4	22,686	a-b	44,579	5
	b	11/16	16,008	b-c	70,014	"
E	c	11/16	14,040	c-d	92,830	"
	d	5/8	12,502	d-e	118,789	$2\frac{1}{2}$ DEH
	e	3/4	13,404	e-f	138,553	"
		Mast Weight 36.44 kips			Leg Spacing 6 ft	

Table 8 (Continued)

Tower Data For Figure 28

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	3/4	21,967	a-b	43,782	6
	b	5/8	13,465	b-c	65,701	"
F	c	11/16	13,341	c-d	89,055	"
	d	5/8	12,066	d-e	116,253	3 DEH
	e	3/4	13,215	e-f	138,471	"
		Mast Weight 39.56 kips			Leg Spacing 4 ft	
	a	3/4	22,689	a-b	43,961	5
	b	5/8	14,003	b-c	65,866	"
F	c	11/16	14,031	c-d	88,867	"
	d	5/8	12,652	d-e	115,875	4 EH
	e	3/4	13,873	e-f	137,678	"
		Mast Weight 35.40 kips			Leg Spacing 5 ft	
	a	3/4	22,297	a-b	44,148	5
	b	5/8	14,565	b-c	66,854	"
F	c	11/16	14,751	c-d	90,850	"
	d	5/8	13,263	d-e	119,021	"
	e	3/4	14,560	e-f	141,615	"
		Mast Weight 37.05 kips			Leg Spacing 6 ft	

Table 9

Tower Data For Figure 30

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	50,785	a-b	90,958	4 DEH
	b	15/16	39,648	b-c	169,345	"
A	c	13/16	22,712	c-d	216,265	"
	d	5/8	14,646	d-e	280,869	"
	e	5/8	12,052	e-f	314,862	"
		Mast Weight 76.33 kips			Leg Spacing 5 ft	
	a	7/8	51,876	a-b	91,704	4 DEH
	b	15/16	41,336	b-c	174,042	"
A	c	13/16	23,759	c-d	222,749	"
	d	5/8	15,308	d-e	289,974	"
	e	5/8	12,624	e-f	325,311	"
		Mast Weight 79.00 kips			Leg Spacing 6 ft	
	a	7/8	53,001	a-b	93,399	$3\frac{1}{2}$ DEH
	b	15/16	43,075	b-c	176,060	"
A	c	13/16	24,838	c-d	224,366	"
	d	5/8	16,001	d-e	292,322	4 DEH
	e	5/8	13,214	e-f	329,044	"
		Mast Weight 74.71 kips			Leg Spacing 7 ft	

Table 9 (Continued)

Tower Data For Figure 30

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	48,713	a-b	86,932	4 DEH
	b	7/8	37,363	b-c	161,485	"
B	c	13/16	24,036	c-d	209,786	"
	d	5/8	16,539	d-e	286,197	4 DEH
	e	5/8	14,086	e-f	332,485	"
		Mast Weight 83.93 kips			Leg Spacing 5 ft	
	a	7/8	49,689	a-b	88,405	$3\frac{1}{2}$ DEH
	b	7/8	38,941	b-c	163,283	"
B	c	13/16	25,144	c-d	211,350	"
	d	5/8	17,300	d-e	288,961	6 EH
	e	5/8	14,758	e-f	333,350	"
		Mast Weight 73.10 kips			Leg Spacing 6 ft	
	a	7/8	50,695	a-b	89,922	$3\frac{1}{2}$ DEH
	b	15/16	40,903	b-c	167,808	"
B	c	7/8	26,521	c-d	217,859	"
	d	5/8	18,085	d-e	298,735	6 EH
	e	5/8	15,450	e-f	344,870	"
		Mast Weight 75.85 kips			Leg Spacing 7 ft	

Table 9 (Continued)

Tower Data For Figure 30

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	44,589	a-b	80,712	$3\frac{1}{2}$ DEH
	b	7/8	34,137	b-c	145,108	"
C	c	7/8	26,239	c-d	194,723	"
	d	11/16	19,191	d-e	288,313	5 DEH
	e	11/16	17,682	e-f	352,777	"
		Mast Weight 79.67 kips			Leg Spacing 5 ft	
	a	7/8	45,325	a-b	81,822	5 EH
	b	7/8	35,529	b-c	147,848	"
C	c	7/8	27,432	c-d	198,627	"
	d	11/16	20,067	d-e	295,471	5 DEH
	e	11/16	18,524	e-f	362,299	"
		Mast Weight 79.73 kips			Leg Spacing 6 ft	
	a	7/8	46,093	a-b	82,966	5 EH
	b	7/8	36,963	b-c	151,568	"
C	c	7/8	28,661	c-d	204,442	"
	d	11/16	20,970	d-e	305,432	5 DEH
	e	11/16	19,392	e-f	374,800	"
		Mast Weight 82.48 kips			Leg Spacing 7 ft	

Table 9 (Continued)

Tower Data For Figure 30

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	42,571	a-b	77,669	5 EH
	b	7/8	32,870	b-c	137,596	"
D	c	7/8	27,620	c-d	188,776	"
	d	11/16	20,488	d-e	290,530	5 DEH
	e	11/16	19,106	e-f	362,598	"
		Mast Weight 78.13 kips		Leg Spacing 5 ft		
	a	7/8	43,180	a-b	78,588	5 EH
	b	7/8	34,187	b-c	141,546	"
D	c	7/8	28,874	c-d	195,354	"
	d	3/4	21,573	d-e	302,245	5 DEH
	e	3/4	20,100	e-f	377,389	"
		Mast Weight 80.80 kips		Leg Spacing 6 ft		
	a	7/8	43,808	a-b	79,534	5 EH
	b	7/8	35,544	b-c	144,903	"
D	c	15/16	30,452	c-d	200,985	"
	d	3/4	22,536	d-e	312,440	5 DEH
	e	3/4	21,037	e-f	390,459	"
		Mast Weight 83.54 kips		Leg Spacing 7 ft		

Table 9 (Continued)

Tower Data For Figure 30

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
			Leg Spacing 5 ft			
E	6 DEH pipe was the largest size pipe available; this was not large enough for the legs for the bottom 200 feet.					
	a	7/8	40,681	a-b	74,820	3 DEH
	b	3/4	25,616	b-c	123,406	"
E	c	7/8	31,770	c-d	179,438	"
	d	13/16	27,676	d-e	329,961	6 DEH
	e	7/8	28,497	e-f	462,156	"
		Mast Weight 101.68 kips			Leg Spacing 6 ft	
	a	7/8	41,094	a-b	75,442	3 DEH
	b	3/4	26,548	b-c	125,701	"
E	c	15/16	33,541	c-d	184,164	"
	d	13/16	28,893	d-e	341,137	6 DEH
	e	7/8	29,823	e-f	478,235	"
		Mast Weight 104.43 kips			Leg Spacing 7 ft	

Table 10

Tower Data For Figure 31

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	43,964	a-b	76,598	$3\frac{1}{2}$ DEH
	b	15/16	35,414	b-c	143,079	"
A	c	7/8	21,468	c-d	183,129	"
	d	5/8	14,094	d-e	245,763	4 DEH
	e	5/8	11,921	e-f	279,563	"
		Mast Weight 69.30 kips			Leg Spacing 5 ft	
	a	7/8	44,895	a-b	77,914	5 EH
	b	15/16	36,906	b-c	145,747	"
A	c	7/8	22,433	c-d	186,355	"
	d	5/8	14,742	d-e	250,741	4 DEH
	e	5/8	12,487	e-f	286,077	"
		Mast Weight 68.86			Leg Spacing 6 ft	
	a	7/8	45,854	a-b	79,271	5 EH
	b	15/16	38,442	b-c	149,777	"
A	c	7/8	23,427	c-d	191,983	"
	d	5/8	15,409	d-e	259,070	4 DEH
	e	5/8	13,080	e-f	295,792	"
		Mast Weight 71.61 kips			Leg Spacing 7 ft	

Table 10 (Continued)

Tower Data For Figure 31

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	42,195	a-b	74,097	3½ DEH
	b	15/16	33,556	b-c	136,595	"
B	c	7/8	22,508	c-d	177,638	"
	d	5/8	15,776	d-e	252,079	4 DEH
	e	5/8	13,904	e-f	294,404	"
		Mast Weight 69.72 kips			Leg Spacing 5 ft	
	a	7/8	43,028	a-b	75,275	4 EH
	b	15/16	34,943	b-c	139,078	"
B	c	7/8	23,519	c-d	180,805	"
	d	5/8	16,503	d-e	257,546	4 DEH
	e	5/8	14,567	e-f	301,565	"
		Mast Weight 69.47 kips			Leg Spacing 6 ft	
	a	7/8	43,886	a-b	76,489	6
	b	15/16	36,373	b-c	141,811	"
B	c	7/8	24,562	c-d	184,389	"
	d	5/8	17,251	d-e	263,636	4 DEH
	e	5/8	15,250	e-f	309,400	"
		Mast Weight 69.66 kips			Leg Spacing 7 ft	

Table 10 (Continued)

Tower Data For Figure 31

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	38,674	a-b	69,120	6
	b	7/8	30,160	b-c	122,971	"
C	c	7/8	23,981	c-d	164,938	"
	d	11/16	18,012	d-e	256,999	5 DEH
	e	11/16	17,327	e-f	321,364	"
		Mast Weight 74.78 kips		Leg Spacing 5 ft		
	a	7/8	39,302	a-b	70,008	3 DEH
	b	7/8	31,375	b-c	125,802	"
C	c	7/8	25,055	c-d	169,339	"
	d	11/16	18,834	d-e	265,259	5 DEH
	e	11/16	18,152	e-f	332,088	"
		Mast Weight 76.96 kips		Leg Spacing 6 ft		
	a	7/8	39,950	a-b	70,923	3 DEH
	b	7/8	32,626	b-c	128,888	"
C	c	15/16	26,434	c-d	174,257	"
	d	11/16	19,682	d-e	274,323	5 DEH
	e	11/16	19,002	e-f	343,692	"
		Mast Weight 79.71 kips		Leg Spacing 7 ft		

Table 10 (Continued)

Tower Data For Figure 31

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	36,952	a-b	66,685	3 DEH
	b	7/8	28,952	b-c	117,177	"
D	c	15/16	25,381	c-d	160,986	"
	d	11/16	19,107	d-e	261,815	5 DEH
	e	11/16	18,672	e-f	333,884	"
		Mast Weight 75.49 kips			Leg Spacing 5 ft	
	a	7/8	37,472	a-b	67,420	3 DEH
	b	7/8	30,098	b-c	119,875	"
D	c	15/16	26,505	c-d	165,506	"
	d	11/16	19,980	d-e	270,768	5 DEH
	e	11/16	19,562	e-f	345,629	"
		Mast Weight 78.16 kips			Leg Spacing 6 ft	
	a	7/8	38,007	a-b	68,178	3 DEH
	b	7/8	31,278	b-c	123,301	"
D	c	15/16	27,663	c-d	171,281	"
	d	11/16	20,879	d-e	281,655	5 DEH
	e	3/4	20,559	e-f	359,674	"
		Mast Weight 80.90 kips			Leg spacing 7 ft	

Table 10 (Continued)

Tower Data For Figure 31

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	34,997	a-b	63,923	3 DEH
	b	3/4	21,660	b-c	103,464	"
E	c	7/8	27,088	c-d	148,918	"
	d	3/4	23,816	d-e	292,176	6 DEH
	e	13/16	26,111	e-f	419,215	"
		Mast Weight 99.01 kips		Leg Spacing 5 ft		
	a	7/8	35,338	a-b	64,405	4 EH
	b	3/4	22,440	b-c	105,100	"
E	c	15/16	28,637	c-d	151,977	"
	d	3/4	24,886	d-e	300,996	6 DEH
	e	7/8	27,442	e-f	433,191	"
		Mast Weight 98.44 kips		Leg Spacing 6 ft		
	a	7/8	35,691	a-b	64,903	5
	b	3/4	23,244	b-c	106,913	"
E	c	15/16	29,896	c-d	155,649	"
	d	11/16	26,159	d-e	311,196	6 DEH
	e	7/8	28,719	e-f	448,294	"
		Mast Weight 100.86 kips		Leg Spacing 7 ft		

Table 11

Tower Data For Figure 32

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	51,030	a-b	90,695	4 DEH
	b	15/16	39,907	b-c	171,074	"
A	c	13/16	22,896	c-d	218,664	"
	d	11/16	15,048	d-e	261,417	"
	e	11/16	12,485	e-f	285,816	"
		Mast Weight 76.33 kips			Leg Spacing 5 ft	
	a	7/8	52,118	a-b	92,333	4 DEH
	b	15/16	41,590	b-c	175,751	"
A	c	13/16	23,939	c-d	225,120	"
	d	11/16	15,716	d-e	269,441	"
	e	11/16	13,053	e-f	294,697	"
		Mast Weight 79.00 kips			Leg Spacing 6 ft	
	a	7/8	53,240	a-b	94,022	$3\frac{1}{2}$ DEH
	b	15/16	43,324	b-c	177,758	"
A	c	13/16	25,014	c-d	226,709	"
	d	11/16	16,406	d-e	270,677	4 DEH
	e	11/16	13,640	e-f	296,817	"
		Mast Weight 74.71 kips			Leg Spacing 7 ft	

Table 11 (Continued)

Tower Data For Figure 32

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	48,964	a-b	87,584	4 DEH
	b	7/8	37,587	b-c	163,772	"
B	c	13/16	24,221	c-d	213,188	"
	d	11/16	16,945	d-e	262,184	"
	e	3/4	14,645	e-f	292,348	"
		Mast Weight 76.33 kips			Leg Spacing 5 ft	
	a	7/8	49,937	a-b	89,049	3½ DEH
	b	7/8	39,159	b-c	165,551	"
B	c	13/16	25,325	c-d	214,726	"
	d	11/16	17,703	d-e	263,594	4 DEH
	e	3/4	15,311	e-f	294,825	"
		Mast Weight 72.39 kips			Leg Spacing 6 ft	
	a	7/8	50,940	a-b	90,559	3½ DEH
	b	15/16	41,166	b-c	170,173	"
B	c	7/8	26,741	c-d	221,410	"
	d	11/16	18,484	d-e	272,176	4 DEH
	e	3/4	15,999	e-f	304,507	"
		Mast Weight 75,139 kips			Leg Spacing 7 ft	

Table 11 (Continued)

Tower Data For Figure 32

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	44,851	a-b	81,396	$3\frac{1}{2}$ DEH
	b	7/8	34,382	b-c	147,650	"
C	c	7/8	26,475	c-d	198,661	"
	d	3/4	19,677	d-e	255,772	5 DEH
	e	13/16	18,294	e-f	300,911	"
		Mast Weight 79.67 kips			Leg Spacing 5 ft	
	a	7/8	45,585	a-b	82,500	5 EH
	b	7/8	35,769	b-c	150,373	"
C	c	7/8	27,662	c-d	202,535	"
	d	3/4	20,549	d-e	261,041	6 EH
	e	13/16	19,130	e-f	303,476	"
		Mast Weight 71.35 kips			Leg Spacing 6 ft	
	a	7/8	46,341	a-b	83,637	5 EH
	b	7/8	37,198	b-c	154,075	"
C	c	7/8	28,887	c-d	208,322	"
	d	3/4	21,448	d-e	269,162	6 EH
	e	13/16	19,992	e-f	313,131	"
		Mast Weight 74.09 kips			Leg Spacing 7 ft	

Table 11 (Continued)

Tower Data For Figure 32

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	42,841	a-b	78,371	$3\frac{1}{2}$ DEH
	b	7/8	33,126	b-c	141,637	"
D	c	7/8	27,855	c-d	195,599	"
	d	3/4	20,977	d-e	257,607	5 DEH
	e	7/8	19,861	e-f	307,802	"
		Mast Weight 80.61 kips			Leg Spacing 5 ft	
	a	7/8	43,448	a-b	79,284	5 EH
	b	7/8	34,438	b-c	144,132	"
D	c	7/8	29,105	c-d	199,359	"
	d	3/4	21,908	d-e	262,965	5 DEH
	e	7/8	20,764	e-f	314,827	"
		Mast Weight 80.80 kips			Leg Spacing 6 ft	
	a	7/8	44,073	a-b	80,225	5 EH
	b	7/8	35,790	b-c	147,473	"
D	c	15/16	30,728	c-d	205,073	"
	d	13/16	23,062	d-e	271,468	5 DEH
	e	7/8	21,695	e-f	325,048	"
		Mast Weight 83.54 kips			Leg Spacing 7 ft	

Table 11 (Continued)

Tower Data For Figure 32

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	40,559	a-b	74,940	3 DEH
	b	3/4	24,908	b-c	123,117	"
E	c	7/8	30,629	c-d	178,022	"
	d	13/16	26,967	d-e	258,947	6 DEH
	e	15/16	27,829	e-f	345,598	"
		Mast Weight 99.01 kips			Leg Spacing 5 ft	
	a	7/8	40,958	a-b	75,539	3 DEH
	b	3/4	25,808	b-c	126,065	"
E	c	7/8	32,012	c-d	183,836	"
	d	13/16	28,044	d-e	268,624	6 DEH
	e	1	29,284	e-f	358,370	"
		Mast Weight 101.68 kips			Leg Spacing 6 ft	
	a	7/8	41,369	a-b	76,157	3 DEH
	b	3/4	26,735	b-c	128,347	"
E	c	15/16	33,830	c-d	188,664	"
	d	7/8	29,511	d-e	277,207	6 DEH
	e	1	30,602	e-f	369,775	"
		Mast Weight 104.43 kips			Leg Spacing 7 ft	

Table 12

Tower Data For Figure 33

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	44,165	a-b	77,089	$3\frac{1}{2}$ DEH
	b	15/16	35,642	b-c	144,494	"
A	c	7/8	21,663	c-d	185,191	"
	d	5/8	14,355	d-e	225,824	"
	e	11/16	12,347	e-f	248,816	"
		Mast Weight 66.48 kips		Leg Spacing 5 ft		
	a	7/8	45,094	a-b	78,400	$3\frac{1}{2}$ DEH
	b	15/16	37,118	b-c	148,390	"
A	c	7/8	22,623	c-d	190,630	"
	d	5/8	15,000	d-e	232,835	"
	e	11/16	12,910	e-f	256,684	"
		Mast Weight 69.15 kips		Leg Spacing 6 ft		
	a	7/8	46,051	a-b	79,751	5 EH
	b	15/16	38,651	b-c	151,163	"
A	c	7/8	23,613	c-d	194,001	"
	d	11/16	15,796	d-e	237,099	$3\frac{1}{2}$ DEH
	e	11/16	13,490	e-f	261,832	"
		Mast Weight 68.79 kips		Leg Spacing 7 ft		

Table 12 (Continued)

Tower Data For Figure 33

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	42,401	a-b	74,599	3½ DEH
	b	15/16	33,684	b-c	138,650	"
B	c	7/8	22,703	c-d	180,772	"
	d	11/16	16,161	d-e	227,798	4 DEH
	e	3/4	14,452	e-f	257,962	"
		Mast Weight 69.72 kips			Leg Spacing 5 ft	
	a	7/8	43,231	a-b	75,772	5 EH
	b	15/16	35,166	b-c	141,107	"
B	c	7/8	23,710	c-d	183,916	"
	d	11/16	16,884	d-e	231,914	3½ DEH
	e	3/4	15,110	e-f	261,457	"
		Mast Weight 66.23 kips			Leg Spacing 6 ft	
	a	7/8	44,088	a-b	76,980	5 EH
	b	15/16	36,592	b-c	144,802	"
B	c	7/8	24,748	c-d	189,270	"
	d	11/16	17,630	d-e	239,166	3½ DEH
	e	3/4	15,789	e-f	269,809	"
		Mast Weight 68.98 kips			Leg Spacing 7 ft	

Table 12 (Continued)

Tower Data For Figure 33

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	38,890	a-b	69,647	5 EH
	b	7/8	30,364	b-c	125,904	"
C	c	7/8	24,179	c-d	169,889	"
	d	11/16	18,284	d-e	225,921	6 EH
	e	13/16	17,922	e-f	266,869	"
		Mast Weight 68.68 kips			Leg Spacing 5 ft	
	a	7/8	39,516	a-b	70,530	3 DEH
	b	7/8	31,574	b-c	127,961	"
C	c	7/8	25,249	c-d	172,747	"
	d	3/4	19,285	d-e	230,329	4 DEH
	e	13/16	18,741	e-f	272,331	"
		Mast Weight 67.71 kips			Leg Spacing 6 ft	
	a	7/8	40,162	a-b	71,441	3 DEH
	b	7/8	32,822	b-c	131,034	"
C	c	15/16	26,666	c-d	177,726	"
	d	3/4	20,128	d-e	237,641	4 DEH
	e	11/16	19,586	e-f	281,178	"
		Mast Weight 70.46 kips			Leg Spacing 7 ft	

Table 12 (Continued)

Tower Data For Figure 33

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	37,173	a-b	67,226	6
	b	7/8	29,164	b-c	119,580	"
D	c	15/16	25,623	c-d	164,948	"
	d	3/4	19,561	d-e	224,991	5 DEH
	e	13/16	19,258	e-f	274,861	"
		Mast Weight 75.96 kips			Leg Spacing 5 ft	
	a	7/8	37,691	a-b	67,947	3 DEH
	b	7/8	30,305	b-c	122,125	"
D	c	15/16	26,742	c-d	169,140	"
	d	3/4	20,430	d-e	231,488	6 EH
	e	13/16	20,142	e-f	278,537	"
		Mast Weight 69.18 kips			Leg Spacing 6 ft	
	a	7/8	38,225	a-b	68,710	3 DEH
	b	7/8	31,481	b-c	125,500	"
D	c	15/16	27,895	c-d	174,838	"
	d	3/4	21,325	d-e	240,065	4 DEH
	e	7/8	21,197	e-f	288,691	"
		Mast Weight 71.00 kips			Leg Spacing 7 ft	

Table 12 (Continued)

Tower Data For Figure 33

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	35,225	a-b	64,480	3 DEH
	b	3/4	21,820	b-c	105,736	"
E	c	7/8	27,294	c-d	152,735	"
	d	13/16	24,325	d-e	233,658	6 DEH
	e	15/16	26,793	e-f	320,210	"
		Mast Weight 99.01 kips			Leg Spacing 5 ft	
	a	7/8	35,565	a-b	64,960	3 DEH
	b	3/4	22,598	b-c	107,569	"
E	c	15/16	28,841	c-d	156,619	"
	d	13/16	25,390	d-e	240,881	5 DEH
	e	15/16	28,026	e-f	321,409	"
		Mast Weight 84.15 kips			Leg Spacing 6 ft	
	a	7/8	35,916	a-b	65,454	4 EH
	b	3/4	23,399	b-c	109,288	"
E	c	15/16	30,137	c-d	159,785	"
	d	11/16	26,488	d-e	246,719	5 DEH
	e	1	29,462	e-f	330,520	"
		Mast Weight 83.66 kips			Leg Spacing 7 ft	

Table 13

Tower Data For Figure 34

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	40,041	a-b	68,132	5 EH
	b	15/16	33,164	b-c	127,594	"
A	c	7/8	20,913	c-d	164,179	"
	d	5/8	14,043	d-e	203,943	"
	e	11/16	12,271	e-f	226,314	"
		Mast Weight 62.14			Leg Spacing 5 ft	
	a	7/8	40,870	a-b	69,225	5 EH
	b	15/16	34,533	b-c	130,968	"
A	c	15/16	22,108	c-d	169,028	"
	d	5/8	14,675	d-e	210,363	"
	e	11/16	12,830	e-f	233,591	"
		Mast Weight 64.80 kips			Leg Spacing 6 ft	
	a	7/8	41,726	a-b	70,351	6
	b	1	36,299	b-c	133,470	"
A	c	15/16	23,048	c-d	172,091	"
	d	5/8	15,326	d-e	214,286	5 EH
	e	11/16	13,407	e-f	238,398	"
		Mast Weight 64.84 kips			Leg Spacing 7 ft	

Table 13 (Continued)

Tower Data For Figure 34

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	38,465	a-b	66,057	5 EH
	b	15/16	31,355	b-c	121,974	"
B	c	7/8	21,767	c-d	159,300	"
	d	5/8	15,583	d-e	205,043	3½ DEH
	e	11/16	14,210	e-f	233,284	"
		Mast Weight 63.57 kips			Leg Spacing 5 ft	
	a	7/8	39,207	a-b	67,034	3 DEH
	b	15/16	32,624	b-c	124,445	"
B	c	15/16	23,013	c-d	162,719	"
	d	11/16	16,420	d-e	209,793	3½ DEH
	e	3/4	14,999	e-f	239,335	"
		Mast Weight 63.13 kips			Leg Spacing 6 ft	
	a	7/8	39,972	a-b	68,041	3 DEH
	b	15/16	33,931	b-c	127,644	"
B	c	15/16	23,992	c-d	167,396	"
	d	11/16	17,145	d-e	216,368	3½ DEH
	e	3/4	15,672	e-f	247,011	"
		Mast Weight 65.88 kips			Leg Spacing 7 ft	

Table 13 (Continued)

Tower Data For Figure 34

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	35,329	a-b	61,928	3 DEH
	b	7/8	28,012	b-c	110,708	"
C	c	15/16	23,248	c-d	149,424	"
	d	11/16	17,596	d-e	204,230	4 DEH
	e	3/4	17,581	e-f	244,457	"
		Mast Weight 65.04 kips			Leg Spacing 5 ft	
	a	7/8	35,888	a-b	62,664	3 DEH
	b	7/8	29,115	b-c	113,847	"
C	c	15/16	24,248	c-d	154,524	"
	d	11/16	18,386	d-e	211,900	4 DEH
	e	13/16	18,525	e-f	253,903	"
		Mast Weight 67.71 kips			Leg Spacing 6 ft	
	a	7/8	36,465	a-b	63,424	3 DEH
	b	15/16	30,637	b-c	116,620	"
C	c	15/16	25,278	c-d	158,869	"
	d	11/16	19,199	d-e	218,584	4 DEH
	e	13/16	19,361	e-f	262,121	"
		Mast Weight 70.46 kips			Leg Spacing 7 ft	

Table 13 (Continued)

Tower Data For Figure 34

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	33,795	a-b	59,910	3 DEH
	b	7/8	26,836	b-c	106,306	"
D	c	15/16	24,210	c-d	147,143	"
	d	11/16	18,563	d-e	206,808	6 EH
	e	13/16	19,006	e-f	252,187	"
		Mast Weight 66.51 kips		Leg Spacing 5 ft		
	a	7/8	34,258	a-b	60,519	3 DEH
	b	7/8	27,873	b-c	108,620	"
D	c	15/16	25,252	c-d	151,058	"
	d	3/4	19,576	d-e	213,405	4 DEH
	e	13/16	19,880	e-f	259,990	"
		Mast Weight 68.25 kips		Leg Spacing 6 ft		
	a	7/8	34,735	a-b	61,141	3 DEH
	b	7/8	28,941	b-c	111,006	"
D	c	15/16	26,326	c-d	155,093	"
	d	3/4	20,435	d-e	219,985	4 DEH
	e	13/16	20,708	e-f	268,292	"
		Mast Weight 71.00 kips		Leg Spacing 7 ft		

Table 13 (Continued)

Tower Data For Figure 34

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	32,055	a-b	57,620	4 EH
	b	3/4	20,003	b-c	93,523	"
E	c	15/16	25,744	c-d	134,412	"
	d	3/4	22,611	d-e	213,752	6 DEH
	e	15/16	26,210	e-f	300,305	"
		Mast Weight 95.77 kips			Leg Spacing 5 ft	
	a	7/8	32,359	a-b	58,020	5
	b	3/4	20,702	b-c	95,015	"
E	c	15/16	26,860	c-d	137,443	"
	d	13/16	23,819	d-e	220,279	5 DEH
	e	15/16	27,417	e-f	300,808	"
		Mast Weight 80.58 kips			Leg Spacing 6 ft	
	a	7/8	32,672	a-b	58,433	$2\frac{1}{2}$ DEH
	b	3/4	21,426	b-c	96,422	"
E	c	15/16	28,010	c-d	140,270	"
	d	13/16	24,850	d-e	226,217	5 DEH
	e	15/16	28,661	e-f	309,573	"
		Mast Weight 82.50 kips			Leg Spacing 7 ft	

Table 14

Tower Data For Figure 35

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	44,424	a-b	77,722	$3\frac{1}{2}$ DEH
	b	15/16	35,912	b-c	146,768	"
A	c	7/8	21,913	c-d	188,612	"
	d	3/4	15,080	d-e	222,762	"
	e	13/16	13,152	e-f	243,126	"
		Mast Weight 66.48 kips			Leg Spacing 5 ft	
	a	7/8	45,350	a-b	79,026	$3\frac{1}{2}$ DEH
	b	15/16	37,393	b-c	150,645	"
A	c	7/8	22,868	c-d	194,023	"
	d	3/4	15,719	d-e	229,387	"
	e	13/16	13,707	e-f	250,441	"
		Mast Weight 69.15 kips			Leg Spacing 6 ft	
	a	7/8	46,305	a-b	80,370	5 EH
	b	15/16	38,920	b-c	153,399	"
A	c	7/8	23,852	c-d	197,366	"
	d	3/4	16,378	d-e	233,112	"
	e	13/16	14,279	e-f	254,258	"
		Mast Weight 67.55 kips			Leg Spacing 7 ft	

Table 14 (Continued)

Tower Data For Figure 35

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	42,666	a-b	75,247	$3\frac{1}{2}$ DEH
	b	15/16	34,077	b-c	140,988	"
B	c	7/8	22,955	c-d	184,339	"
	d	3/4	16,748	d-e	222,839	4 DEH
	e	7/8	15,320	e-f	249,525	"
		Mast Weight 69.72 kips			Leg Spacing 5 ft	
	a	7/8	43,494	a-b	76,413	5 EH
	b	15/16	35,454	b-c	143,435	"
B	c	7/8	23,956	c-d	187,454	"
	d	3/4	17,467	d-e	226,479	$3\frac{1}{2}$ DEH
	e	7/8	15,969	e-f	252,331	"
		Mast Weight 66.23 kips			Leg Spacing 6 ft	
	a	7/8	44,348	a-b	77,614	5 EH
	b	15/16	36,873	b-c	147,112	"
B	c	7/8	24,989	c-d	192,779	"
	d	3/4	18,207	d-e	223,243	$3\frac{1}{2}$ DEH
	e	7/8	16,639	e-f	259,976	"
		Mast Weight 68.98 kips			Leg Spacing 7 ft	

Table 14 (Continued)

Tower Data For Figure 35

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	39,168	a-b	70,326	5 EH
	b	7/8	30,626	b-c	128,361	"
C	c	7/8	24,435	c-d	173,730	"
	d	13/16	19,116	d-e	218,523	4 DEH
	e	15/16	18,860	e-f	253,332	"
		Mast Weight 67.82 kips			Leg Spacing 5 ft	
	a	7/8	39,792	a-b	71,204	3 DEH
	b	7/8	31,832	b-c	130,401	"
C	c	7/8	25,500	c-d	176,560	"
	d	13/16	19,929	d-e	222,102	4 DEH
	e	15/16	19,670	e-f	258,067	"
		Mast Weight 67.71 kips			Leg Spacing 6 ft	
	a	7/8	40,435	a-b	72,108	3 DEH
	b	7/8	33,074	b-c	133,456	"
C	c	15/16	26,965	c-d	181,616	"
	d	13/16	20,767	d-e	228,883	4 DEH
	e	15/16	20,505	e-f	266,041	"
		Mast Weight 70.46 kips			Leg Spacing 7 ft	

Table 14 (Continued)

Tower Data For Figure 35

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
			Leg Spacing 5 ft			
D	With 3/4 inch top guys, no commercial size of wire rope was available which would control the bending of the mast within the limit set without adjusting the length of the guys.					
	a	7/8	37,974	a-b	68,648	3 DEH
	b	7/8	30,573	b-c	125,306	"
D	c	15/16	27,047	c-d	174,339	"
	d	13/16	21,073	d-e	223,472	4 DEH
	e	1	21,307	e-f	263,413	"
		Mast Weight 68.25 kips			Leg Spacing 6 ft	
	a	7/8	38,506	a-b	69,396	3 DEH
	b	7/8	31,744	b-c	128,057	"
D	c	15/16	38,194	c-d	178,945	"
	d	13/16	21,963	d-e	229,943	4 DEH
	e	1	22,206	e-f	271,210	"
		Mast Weight 71.00 kips			Leg Spacing 7 ft	

Table 14 (Continued)

Tower Data For Figure 35

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	35,519	a-b	65,198	3 DEH
	b	3/4	22,028	b-c	109,171	"
E	c	7/8	27,560	c-d	158,582	"
	d	7/8	25,071	d-e	220,308	6 DEH
	e	1 1/8	28,177	e-f	294,943	"
		Mast Weight 99.01 kips			Leg Spacing 5 ft	
	a	7/8	35,858	a-b	65,674	3 DEH
	b	3/4	22,802	b-c	110,991	"
E	c	15/16	29,201	c-d	162,565	"
	d	7/8	26,130	d-e	226,647	5 DEH
	e	1 1/8	29,395	e-f	294,571	"
		Mast Weight 84.15 kips			Leg Spacing 6 ft	
	a	7/8	36,207	a-b	66,165	3 DEH
	b	3/4	23,600	b-c	112,868	"
E	c	15/16	80,448	c-d	166,384	"
	d	7/8	27,221	d-e	232,897	5 DEH
	e	1 1/8	30,651	e-f	302,940	"
		Mast Weight 86.90 kips			Leg Spacing 7 ft	

Table 15

Tower Data For Figure 36

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	40,263	a-b	68,639	$3\frac{1}{2}$ DEH
	b	15/16	33,408	b-c	130,853	"
A	c	7/8	21,134	c-d	169,516	"
	d	11/16	14,531	d-e	203,473	5 EH
	e	13/16	13,069	e-f	223,215	"
		Mast Weight 65.24 kips		Leg Spacing 5 ft		
	a	7/8	41,091	a-b	69,726	5 EH
	b	15/16	34,772	b-c	132,970	"
A	c	15/16	22,372	c-d	172,177	"
	d	11/16	15,159	d-e	206,483	"
	e	13/16	13,619	e-f	226,916	"
		Mast Weight 64.80 kips		Leg Spacing 6 ft		
	a	7/8	41,943	a-b	70,847	6
	b	1	36,580	b-c	135,548	"
A	c	15/16	23,307	c-d	175,308	"
	d	3/4	16,020	d-e	210,294	5 EH
	e	13/16	14,188	e-f	231,440	"
		Mast Weight 64.84 kips		Leg Spacing 7 ft		

Table 15 (Continued)

Tower Data For Figure 36

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	38,692	a-b	66,575	5 EH
	b	15/16	31,610	b-c	124,612	"
B	c	7/8	21,988	c-d	163,499	"
	d	3/4	16,285	d-e	201,130	$3\frac{1}{2}$ DEH
	e	7/8	15,203	e-f	226,127	"
		Mast Weight 63.57 kips			Leg Spacing 5 ft	
	a	7/8	39,432	a-b	67,547	3 DEH
	b	15/16	32,874	b-c	126,512	"
B	c	15/16	23,277	c-d	166,004	"
	d	3/4	16,984	d-e	204,106	5 EH
	e	7/8	15,848	e-f	229,212	"
		Mast Weight 61.70 kips			Leg Spacing 6 ft	
	a	7/8	40,195	a-b	68,549	3 DEH
	b	15/16	34,176	b-c	129,695	"
B	c	15/16	24,251	c-d	170,658	"
	d	3/4	17,704	d-e	210,198	5 EH
	e	7/8	16,513	e-f	236,186	"
		Mast Weight 64.45 kips			Leg Spacing 7 ft	

Table 15 (Continued)

Tower Data For Figure 36

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	35,567	a-b	62,472	3 DEH
	b	7/8	28,239	b-c	112,868	"
C	c	15/16	23,521	c-d	152,927	"
	d	3/4	18,161	d-e	196,220	4 DEH
	e	7/8	18,405	e-f	230,651	"
		Mast Weight 65.04 kips			Leg Spacing 5 ft	
	a	7/8	36,125	a-b	63,204	3 DEH
	b	7/8	29,337	b-c	116,021	"
C	c	15/16	24,515	c-d	158,074	"
	d	3/4	18,946	d-e	203,346	4 DEH
	e	15/16	19,438	e-f	239,310	"
		Mast Weight 67.71 kips			Leg Spacing 6 ft	
	a	7/8	36,699	a-b	63,958	3 DEH
	b	15/16	30,903	b-c	118,879	"
C	c	15/16	25,540	c-d	162,494	"
	d	13/16	19,982	d-e	209,762	4 DEH
	e	15/16	20,264	e-f	246,919	"
		Mast Weight 70.46 kips			Leg Spacing 7 ft	

Table 15 (Continued)

Tower Data For Figure 36

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	34,040	a-b	60,467	3 DEH
	b	7/8	27,072	b-c	108,576	"
D	c	15/16	24,482	c-d	150,846	"
	d	13/16	19,362	d-e	197,843	4 DEH
	e	15/16	19,915	e-f	236,079	"
		Mast Weight 65.58 kips			Leg Spacing 5 ft	
	a	7/8	34,501	a-b	61,072	3 DEH
	b	7/8	28,104	b-c	110,877	"
D	c	15/16	25,518	c-d	154,747	"
	d	13/16	20,190	d-e	203,542	4 DEH
	e	15/16	20,779	e-f	243,068	"
		Mast Weight 68.25 kips			Leg Spacing 6 ft	
	a	7/8	34,976	a-b	61,696	3 DEH
	b	7/8	29,168	b-c	113,885	"
D	c	15/16	26,586	c-d	159,882	"
	d	13/16	21,043	d-e	210,880	4 DEH
	e	1	21,910	e-f	252,147	"
		Mast Weight 71.00 kips			Leg Spacing 7 ft	

Table 15 (Continued)

Tower Data For Figure 36

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	7/8	32,307	a-b	58,194	4 EH
	b	3/4	20,179	b-c	96,672	"
E	c	15/16	26,026	c-d	139,960	"
	d	13/16	23,235	d-e	200,015	5 DEH
	e	1 1/8	27,555	e-f	265,884	"
		Mast Weight 78.24 kips			Leg Spacing 5 ft	
	a	7/8	32,610	a-b	58,591	5
	b	3/4	20,878	b-c	98,155	"
E	c	15/16	27,135	c-d	142,968	"
	d	13/16	24,231	d-e	205,258	5 DEH
	e	1 1/8	28,746	e-f	273,182	"
		Mast Weight 80.58 kips			Leg Spacing 6 ft	
	a	7/8	32,922	a-b	59,001	5
	b	3/4	21,598	b-c	99,772	"
E	c	15/16	28,279	c-d	146,272	"
	d	7/8	25,535	d-e	211,359	5 DEH
	e	1 1/8	29,976	e-f	281,402	"
		Mast Weight 83.33 kips			Leg Spacing 7 ft	

Table 16

Tower Data For Figure 38

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	62,370	a-b	111,221	5 DEH
	b	1 1/4	58,252	b-c	231,489	"
A	c	1 1/8	36,412	c-d	310,103	"
	d	7/8	22,720	d-e	388,883	"
	e	7/8	18,716	e-f	434,131	"
		Mast Weight 131.30 kips		Leg Spacing 6 ft		
	a	1 1/8	65,116	a-b	115,381	5 DEH
	b	1 1/4	62,777	b-c	243,802	"
A	c	1 1/4	40,118	c-d	327,880	"
	d	7/8	24,631	d-e	412,014	"
	e	7/8	20,320	e-f	460,114	"
		Mast Weight 138.44 kips		Leg Spacing 8 ft		
	a	1 1/8	67,957	a-b	119,684	5 DEH
	b	1 3/8	68,520	b-c	264,283	"
A	c	1 1/4	43,180	c-d	359,821	"
	d	15/16	26,791	d-e	454,963	6 DEH
	e	15/16	22,130	e-f	516,269	"
		Mast Weight 182.14 kips		Leg Spacing 10 ft		

Table 16 (Continued)

Tower Data For Figure 38

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	58,767	a-b	105,766	5 DEH
	b	1 1/4	54,391	b-c	217,346	"
B	c	1 1/4	38,645	c-d	297,485	"
	d	15/16	25,513	d-e	389,359	6 DEH
	e	15/16	22,792	e-f	454,962	"
		Mast Weight 145.33 kips		Leg Spacing 6 ft		
	a	1 1/8	61,152	a-b	109,376	5 DEH
	b	1 1/4	58,502	b-c	229,176	"
B	c	1 1/4	41,700	c-d	315,104	"
	d	15/16	27,639	d-e	413,742	6 DEH
	e	1	24,914	e-f	483,579	"
		Mast Weight 152.47 kips		Leg Spacing 8 ft		
	a	1 1/8	63,618	a-b	113,111	5 DEH
	b	1 1/4	62,755	b-c	246,309	"
B	c	1 1/4	44,862	c-d	342,829	"
	d	15/16	29,838	d-e	452,968	6 DEH
	e	7/8	26,940	e-f	531,134	"
		Mast Weight 184.33 kips		Leg Spacing 10 ft		

Table 16 (Continued)

Tower Data For Figure 38

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	55,069	a-b	100,169	5 DEH
	b	1 1/4	51,382	b-c	204,109	"
C	c	1 1/4	40,845	c-d	287,541	"
	d	15/16	28,240	d-e	391,815	6 DEH
	e	1	26,106	e-f	470,155	"
		Mast Weight 147.08 kips		Leg Spacing 6 ft		
	a	1 1/8	57,074	a-b	103,203	5 DEH
	b	1 1/4	55,160	b-c	215,787	"
C	c	1 1/4	44,069	c-d	306,054	"
	d	1	30,825	d-e	419,065	6 DEH
	e	1 1/8	28,725	e-f	503,071	"
		Mast Weight 154.22 kips		Leg Spacing 8 ft		
	a	1 1/8	59,148	a-b	106,342	5 DEH
	b	1 1/4	59,068	b-c	230,855	"
C	c	1 1/4	47,404	c-d	331,727	"
	d	1	33,262	d-e	457,267	6 DEH
	e	1 1/8	31,042	e-f	551,029	"
		Mast Weight 186.08 kips		Leg Spacing 10 ft		

Table 16 (Continued)

Tower Data For Figure 38

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	51,232	a-b	94,365	5 DEH
	b	1 1/4	49,414	b-c	193,115	"
D	c	1 1/4	42,861	c-d	281,741	"
	d	1	30,243	d-e	396,039	6 DEH
	e	1 1/8	28,990	e-f	485,343	"
		Mast Weight 148.39 kips		Leg Spacing 6 ft		
	a	1 1/8	52,831	a-b	96,783	5 DEH
	b	1 1/4	52,958	b-c	201,823	"
D	c	1 1/8	46,240	c-d	296,269	"
	d	1 1/8	33,289	d-e	419,515	6 DEH
	e	1 1/8	31,456	e-f	514,275	"
		Mast Weight 155.54 kips		Leg Spacing 8 ft		
	a	1 1/8	54,484	a-b	99,284	5 DEH
	b	1 1/4	56,626	b-c	214,914	"
D	c	1 3/8	50,676	c-d	320,757	"
	d	1 1/8	35,869	d-e	457,226	6 DEH
	e	1 1/8	34,008	e-f	562,805	"
		Mast Weight 187.40 kips		Leg Spacing 10 ft		

Table 16 (Continued)

Tower Data For Figure 38

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
			Leg Spacing 6 ft			
E	The largest pipe in the basic data (6 DEH) was not large enough to satisfy leg requirements from e to f.					
			Leg Spacing 8 ft			
E	The largest pipe in the basic data (6 DEH) was not large enough to satisfy leg requirements from e to f.					
			Leg Spacing 10 ft			
E	The largest pipe in the basic data (6 DEH) was not large enough to satisfy leg requirements from e to f.					

Table 17

Tower Data For Figure 39

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	52,710	a-b	91,760	5 DEH
	b	1 1/4	50,918	b-c	194,937	"
A	c	1 1/4	34,298	c-d	265,015	"
	d	13/16	21,464	d-e	343,545	"
	e	7/8	18,463	e-f	388,793	"
		Mast Weight 131.30 kips		Leg Spacing 6 ft		
	a	1 1/8	54,988	a-b	94,961	5 DEH
	b	1 3/8	55,819	b-c	205,206	"
A	c	1 1/4	36,975	c-d	279,587	"
	d	7/8	23,450	d-e	363,721	"
	e	7/8	20,045	e-f	411,821	"
		Mast Weight 138.44 kips		Leg Spacing 8 ft		
	a	1 1/8	57,456	a-b	98,273	5 DEH
	b	1 3/8	59,844	b-c	221,981	"
A	c	1 1/4	39,746	c-d	306,525	"
	d	7/8	25,334	d-e	401,096	"
	e	7/8	21,684	e-f	455,955	"
		Mast Weight 170.30 kips		Leg Spacing 10 ft		

Table 17 (Continued)

Tower Data For Figure 39

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	49,721	a-b	87,561	5 DEH
	b	1 1/4	47,342	b-c	183,032	"
B	c	1 1/4	35,197	c-d	253,376	"
	d	7/8	23,740	d-e	344,955	6 DEH
	e	15/16	22,342	e-f	410,538	"
		Mast Weight 145.33 kips		Leg Spacing 6 ft		
	a	1 1/8	51,699	a-b	90,340	4 DEH
	b	1 1/4	50,862	b-c	184,978	"
B	c	1 1/4	37,925	c-d	253,430	"
	d	7/8	25,738	d-e	345,438	5 DEH
	e	15/16	24,265	e-f	407,879	"
		Mast Weight 119.38 kips		Leg Spacing 8 ft		
	a	1 1/8	53,745	a-b	93,214	4 DEH
	b	1 1/4	54,503	b-c	200,636	"
B	c	1 1/4	40,748	c-d	279,352	"
	d	15/16	27,990	d-e	383,546	5 DEH
	e	1	26,408	e-f	454,699	"
		Mast Weight 151.15 kips		Leg Spacing 10 ft		

Table 17 (Continued)

Tower Data For Figure 39

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	46,652	a-b	83,253	6 EH
	b	1 1/4	44,546	b-c	166,443	"
C	c	1 1/4	36,815	c-d	233,710	"
	d	15/16	26,177	d-e	332,595	6 DEH
	e	1	25,469	e-f	410,935	"
		Mast Weight 130.91 kips		Leg Spacing 6 ft		
	a	1 1/8	48,316	a-b	85,588	4 DEH
	b	1 1/4	47,763	b-c	173,785	"
C	c	1 1/4	39,664	c-d	245,074	"
	d	15/16	28,364	d-e	350,790	6 DEH
	e	1	27,663	e-f	433,845	"
		Mast Weight 136.38 kips		Leg Spacing 8 ft		
	a	1 1/8	50,036	a-b	88,004	4 DEH
	b	1 1/4	51,091	b-c	188,612	"
C	c	1 3/8	43,479	c-d	271,186	"
	d	1	30,832	d-e	390,781	6 DEH
	e	1 1/8	30,284	e-f	484,543	"
		Mast Weight 168.25 kips		Leg Spacing 10 ft		

Table 17 (Continued)

Tower Data For Figure 39

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	43,468	a-b	78,785	4 DEH
	b	1 1/4	42,671	b-c	157,597	"
D	c	1 3/8	39,252	c-d	229,004	"
	d	1	27,787	d-e	337,356	6 DEH
	e	1 1/8	28,137	e-f	426,660	"
		Mast Weight 131.55 kips			Leg Spacing 6 ft	
	a	1 1/8	44,795	a-b	80,646	4 DEH
	b	1 1/4	45,675	b-c	164,577	"
D	c	1 3/8	42,129	c-d	240,784	"
	d	1	30,085	d-e	357,213	6 DEH
	e	1 1/8	30,532	e-f	451,974	"
		Mast Weight 138.69 kips			Leg Spacing 8 ft	
	a	1 1/8	46,167	a-b	82,571	4 DEH
	b	1 1/4	48,782	b-c	175,877	"
D	c	1 3/8	45,276	c-d	261,950	"
	d	1 1/8	32,954	d-e	392,473	6 DEH
	e	1 1/8	33,012	e-f	498,052	"
		Mast Weight 170.55 kips			Leg Spacing 10 ft	

Table 17 (Continued)

Tower Data For Figure 39

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
			Leg Spacing 6 ft			
E	The largest pipe in the basic data (6 DEH) was not large enough to satisfy leg requirements from e to f.					
	a	1 1/8	41,774	a-b	76,407	4 DEH
	b	1 1/4	41,151	b-c	152,831	"
E	c	1 3/8	42,642	c-d	230,274	"
	d	1 1/8	32,427	d-e	362,667	6 DEH
	e	1 1/4	35,633	e-f	479,255	"
		Mast Weight 142.53 kips			Leg Spacing 8 ft	
	a	1 1/8	42,822	a-b	77,877	4 DEH
	b	1 1/4	43,811	b-c	162,524	"
E	c	1 3/8	45,701	c-d	248,842	"
	d	1 1/8	34,929	d-e	395,487	6 DEH
	e	1 1/4	38,508	e-f	524,741	"
		Mast Weight 174.39 kips			Leg Spacing 10 ft	

Table 18

Tower Data For Figure 40

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	62,901	a-b	112,613	5 DEH
	b	1 1/4	58,836	b-c	237,419	"
A	c	1 1/8	36,860	c-d	319,009	"
	d	15/16	23,507	d-e	384,704	"
	e	1 1/8	20,324	e-f	425,372	"
		Mast Weight 131.30 kips		Leg Spacing 6 ft		
	a	1 1/8	65,636	a-b	116,743	5 DEH
	b	1 1/4	63,342	b-c	249,654	"
A	c	1 1/4	40,693	c-d	336,962	"
	d	1	25,677	d-e	407,012	"
	e	1 1/8	21,893	e-f	449,908	"
		Mast Weight 138.44 kips		Leg Spacing 8 ft		
	a	1 1/8	68,465	a-b	121,017	5 DEH
	b	1 3/8	69,219	b-c	269,691	"
A	c	1 1/4	43,735	c-d	367,937	"
	d	1	27,636	d-e	447,024	6 DEH
	e	1 1/8	23,520	e-f	502,174	"
		Mast Weight 182.21 kips		Leg Spacing 10 ft		

Table 18 (Continued)

Tower Data For Figure 40

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	59,314	a-b	107,199	5 DEH
	b	1 1/4	55,010	b-c	222,825	"
B	c	1 1/4	39,257	c-d	306,028	"
	d	1	26,391	d-e	380,264	6 DEH
	e	1 1/8	24,196	e-f	438,499	"
		Mast Weight 145.33 kips		Leg Spacing 6 ft		
	a	1 1/8	61,687	a-b	110,781	5 DEH
	b	1 1/4	59,101	b-c	233,786	"
B	c	1 1/4	42,291	c-d	322,185	"
	d	1	28,500	d-e	401,607	6 DEH
	e	1 1/8	26,127	e-f	462,288	"
		Mast Weight 152.47 kips		Leg Spacing 8 ft		
	a	1 1/8	64,143	a-b	114,488	5 DEH
	b	1 1/4	63,334	b-c	252,579	"
B	c	1 1/4	45,433	c-d	352,750	"
	d	1 1/8	31,338	d-e	443,574	6 DEH
	e	1 1/4	28,721	e-f	512,721	"
		Mast Weight 184.33 kips		Leg Spacing 10 ft		

Table 18 (Continued)

Tower Data For Figure 40

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	55,634	a-b	101,650	5 DEH
	b	1 1/4	52,034	b-c	210,869	"
C	c	1 1/4	41,464	c-d	298,303	"
	d	1 1/8	29,826	d-e	383,146	6 DEH
	e	1 1/4	27,927	e-f	451,834	"
		Mast Weight 147.08 kips			Leg Spacing 6 ft	
	a	1 1/8	57,629	a-b	104,658	5 DEH
	b	1 1/4	55,791	b-c	220,622	"
C	c	1 1/4	44,566	c-d	313,525	"
	d	1 1/8	32,155	d-e	403,687	6 DEH
	e	1 1/4	30,134	e-f	475,928	"
		Mast Weight 154.22 kips			Leg Spacing 8 ft	
	a	1 1/8	59,693	a-b	107,771	5 DEH
	b	1 1/4	59,680	b-c	235,616	"
C	c	1 1/4	47,982	c-d	339,080	"
	d	1 1/8	34,567	d-e	439,649	6 DEH
	e	1 1/4	32,423	e-f	520,471	"
		Mast Weight 186.08 kips			Leg Spacing 10 ft	

Table 18 (Continued)

Tower Data For Figure 40

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	51,817	a-b	95,900	5 DEH
	b	1 1/4	50,094	b-c	198,269	"
D	c	1 1/4	43,483	c-d	289,695	"
	d	1 1/8	31,617	d-e	380,522	6 DEH
	e	1 1/4	30,411	e-f	456,741	"
		Mast Weight 148.39 kips		Leg Spacing 6 ft		
	a	1 1/8	53,407	a-b	98,295	5 DEH
	b	1 1/4	53,618	b-c	206,901	"
D	c	1 1/4	46,840	c-d	304,099	"
	d	1 1/8	34,092	d-e	400,709	6 DEH
	e	1 1/4	32,846	e-f	481,013	"
		Mast Weight 155.54 kips		Leg Spacing 8 ft		
	a	1 1/8	55,051	a-b	100,772	5 DEH
	b	1 1/4	57,265	b-c	221,934	"
D	c	1 3/8	51,416	c-d	332,318	"
	d	1 1/8	36,655	d-e	440,838	6 DEH
	e	1 3/8	36,017	e-f	531,889	"
		Mast Weight 187.40 kips		Leg Spacing 10 ft		

Table 18 (Continued)

Tower Data For Figure 40

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
			Leg Spacing 6 ft			
E	The largest pipe in the basic data (6 DEH) was not large enough to satisfy leg requirements from e to f.					
	a	1 1/8	49,787	a-b	92,844	4 DEH
	b	1 1/8	47,115	b-c	186,901	"
E	c	1 1/4	47,771	c-d	280,411	"
	d	1 1/8	36,591	d-e	381,779	6 DEH
	e	1 3/8	38,728	e-f	478,335	"
		Mast Weight 142.53 kips			Leg Spacing 8 ft	
	a	1 1/8	51,043	a-b	94,734	4 DEH
	b	1 1/4	51,672	b-c	198,560	"
E	c	1 3/8	52,462	c-d	303,330	"
	d	1 1/4	40,142	d-e	417,491	6 DEH
	e	1 3/8	41,587	e-f	524,782	"
		Mast Weight 174.39 kips			Leg Spacing 10 ft	

Table 19

Tower Data For Figure 41

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	53,130	a-b	92,781	5 DEH
	b	1 1/4	51,388	b-c	198,396	"
A	c	1 1/4	34,786	c-d	270,327	"
	d	15/16	22,372	d-e	335,363	"
	e	1	19,472	e-f	375,151	"
		Mast Weight 131.30 kips			Leg Spacing 6 ft	
	a	1 1/8	55,400	a-b	95,961	5 DEH
	b	1 3/8	56,397	b-c	210,381	"
A	c	1 1/4	37,446	c-d	287,830	"
	d	15/16	24,178	d-e	357,537	"
	e	1 1/8	21,585	e-f	400,432	"
		Mast Weight 138.44 kips			Leg Spacing 8 ft	
	a	1 1/8	57,748	a-b	99,252	5 DEH
	b	1 3/8	60,404	b-c	227,198	"
A	c	1 1/4	40,201	c-d	314,684	"
	d	15/16	26,049	d-e	393,441	"
	e	1 1/8	23,192	e-f	442,455	"
		Mast Weight 170.30 kips			Leg Spacing 10 ft	

Table 19 (Continued)

Tower Data For Figure 41

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	50,153	a-b	88,613	5 DEH
	b	1 1/4	47,838	b-c	187,698	"
B	c	1 1/4	35,696	c-d	260,666	"
	d	15/16	24,473	d-e	335,010	"
	e	1 1/8	23,706	e-f	385,733	"
		Mast Weight 131.30 kips		Leg Spacing 6 ft		
	a	1 1/8	52,123	a-b	91,371	6 EH
	b	1 1/4	51,342	b-c	190,147	"
B	c	1 1/4	38,407	c-d	261,871	"
	d	1	26,727	d-e	335,904	5 DEH
	e	1 1/8	25,600	e-f	389,572	"
		Mast Weight 121.08 kips		Leg Spacing 8 ft		
	a	1 1/8	54,161	a-b	94,226	6 EH
	b	1 1/4	54,968	b-c	204,994	"
B	c	1 1/4	41,213	c-d	286,394	"
	d	1	28,777	d-e	370,176	5 DEH
	e	1 1/8	27,564	e-f	431249	"
		Mast Weight 152.94 kips		Leg Spacing 10 ft		

Table 19 (Continued)

Tower Data For Figure 41

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	47,099	a-b	84,339	5 DEH
	b	1 1/4	45,066	b-c	175,838	"
C	c	1 1/4	37,316	c-d	250,784	"
	d	1	26,986	d-e	333,757	6 DEH
	e	1 1/8	26,641	e-f	401,275	"
		Mast Weight 147.08 kips		Leg Spacing 6 ft		
	a	1 1/8	48,755	a-b	86,656	4 DEH
	b	1 1/4	48,267	b-c	179,497	"
C	c	1 1/4	40,148	c-d	254,391	"
	d	1	29,157	d-e	337,658	5 DEH
	e	1 1/4	29,384	e-f	402,010	"
		Mast Weight 120.61 kips		Leg Spacing 8 ft		
	a	1 1/8	50,467	a-b	89,053	4 DEH
	b	1 1/4	51,580	b-c	192,511	"
C	c	1 3/8	44,074	c-d	277,464	"
	d	1 1/8	32,033	d-e	372,198	6 DEH
	e	1 1/4	31,618	e-f	453,020	"
		Mast Weight 168.25 kips		Leg Spacing 10 ft		

Table 19 (Continued)

Tower Data For Figure 41

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	43,931	a-b	79,910	6 EH
	b	1 1/4	43,213	b-c	162,253	"
D	c	1 3/8	39,886	c-d	236,879	"
	d	1 1/8	29,042	d-e	322,317	6 DEH
	e	1 1/4	29,503	e-f	398,536	"
		Mast Weight 133.12 kips			Leg Spacing 6 ft	
	a	1 1/8	45,250	a-b	81,754	4 DEH
	b	1 1/4	46,200	b-c	168,715	"
D	c	1 3/8	42,827	c-d	247,549	"
	d	1 1/8	31,317	d-e	338,213	6 DEH
	e	1 1/4	31,869	e-f	418,517	"
		Mast Weight 138.69 kips			Leg Spacing 8 ft	
	a	1 1/8	46,615	a-b	83,663	4 DEH
	b	1 1/4	49,292	b-c	179,964	"
D	c	1 3/8	45,872	c-d	268,626	"
	d	1 1/8	33,673	d-e	370,180	6 DEH
	e	1 1/4	34,322	e-f	459,887	"
		Mast Weight 170.55 kips			Leg Spacing 10 ft	

Table 19 (Continued)

Tower Data For Figure 41

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
			Leg Spacing 6 ft			
E	The largest pipe in the basic data (6 DEH) was not large enough to satisfy leg requirements from e to f.					
	a	1 1/8	42,246	a-b	77,555	4 DEH
	b	1 1/4	41,713	b-c	147,299	"
E	c	1 3/8	43,273	c-d	237,664	"
	d	1 1/8	33,146	d-e	339,032	6 DEH
	e	1 3/8	37,166	e-f	436,588	"
		Mast Weight 142.53 kips		Leg Spacing 8 ft		
	a	1 1/8	43,288	a-b	79,011	4 DEH
	b	1 1/4	44,357	b-c	166,502	"
E	c	1 3/8	46,314	c-d	256,145	"
	d	1 1/8	35,633	d-e	369,084	6 DEH
	e	1 3/8	40,010	e-f	476,364	"
		Mast Weight 174.39 kips		Leg Spacing 10 ft		

Table 20

Tower Data For Figure 42

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	47,743	a-b	80,670	5 DEH
	b	1 3/8	48,467	b-c	176,029	"
A	c	1 3/8	34,383	c-d	242,790	"
	d	7/8	21,546	d-e	307,505	"
	e	1	19,333	e-f	347,294	"
		Mast Weight 131.30 kips		Leg Spacing 6 ft		
	a	1 1/8	49,744	a-b	83,257	6 EH
	b	1 3/8	52,103	b-c	177,210	"
A	c	1 3/8	36,890	c-d	241,466	"
	d	15/16	23,546	d-e	305,124	5 DEH
	e	1	20,885	e-f	347,158	"
		Mast Weight 119.58 kips		Leg Spacing 8 ft		
	a	1 1/8	51,815	a-b	85,933	6 EH
	b	1 3/8	55,752	b-c	194,019	"
A	c	1 3/8	39,486	c-d	269,128	"
	d	15/16	25,370	d-e	342,495	5 DEH
	e	1 1/8	23,025	e-f	391,509	"
		Mast Weight 151.44 kips		Leg Spacing 10 ft		

Table 20 (Continued)

Tower Data For Figure 42

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	45,118	a-b	77,280	6 EH
	b	1 1/4	44,054	b-c	159,873	"
B	c	1 1/4	34,038	c-d	221,181	"
	d	15/16	23,626	d-e	290,135	5 DEH
	e	1 1/8	23,457	e-f	340,858	"
		Mast Weight 113.93 kips		Leg Spacing 6 ft		
	a	1 1/8	46,855	a-b	79,523	4 DEH
	b	1 3/8	48,368	b-c	167,209	"
B	c	1 3/8	37,523	c-d	232,160	"
	d	15/16	25,544	d-e	305,259	5 DEH
	e	1 1/8	25,332	e-f	358,927	"
		Mast Weight 119.28 kips		Leg Spacing 8 ft		
	a	1 1/8	48,652	a-b	81,845	4 DEH
	b	1 3/8	51,648	b-c	180,664	"
B	c	1 3/8	40,144	c-d	254,734	"
	d	15/16	27,530	d-e	337,596	5 DEH
	e	1 1/8	27,277	e-f	398,669	"
		Mast Weight 151.15 kips		Leg Spacing 10 ft		

Table 20 (Continued)

Tower Data For Figure 42

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	42,425	a-b	73,803	4 DEH
	b	1 1/4	41,372	b-c	149,704	"
C	c	1 3/8	36,308	c-d	212,439	"
	d	15/16	25,592	d-e	289,053	5 DEH
	e	1 1/8	26,296	e-f	348,581	"
		Mast Weight 113.46 kips		Leg Spacing 6 ft		
	a	1 1/8	43,885	a-b	75,687	4 DEH
	b	1 1/4	44,260	b-c	156,353	"
C	c	1 3/8	38,933	c-d	223,046	"
	d	1	27,944	d-e	305,427	5 DEH
	e	1 1/8	28,439	e-f	368,633	"
		Mast Weight 130.61 kips		Leg Spacing 8 ft		
	a	1 1/8	45,396	a-b	77,638	4 DEH
	b	1 1/4	47,249	b-c	169,905	"
C	c	1 3/8	41,651	c-d	247,011	"
	d	1	30,101	d-e	340,718	5 DEH
	e	1 1/4	31,208	e-f	413,651	"
		Mast Weight 152.47 kips		Leg Spacing 10 ft		

Table 20 (Continued)

Tower Data For Figure 42

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	39,632	a-b	70,199	4 DEH
	b	1 1/4	39,545	b-c	142,706	"
D	c	1 3/8	37,576	c-d	209,431	"
	d	1	27,040	d-e	293,289	6 DEH
	e	1 1/4	29,039	e-f	369,058	"
		Mast Weight 131.55 kips			Leg Spacing 6 ft	
	a	1 1/8	40,795	a-b	71,700	4 DEH
	b	1 1/4	42,229	b-c	148,564	"
D	c	1 3/8	40,294	c-d	219,436	"
	d	1 1/8	29,842	d-e	310,101	6 DEH
	e	1 1/4	31,370	e-f	390,405	"
		Mast Weight 138.69 kips			Leg Spacing 8 ft	
	a	1 1/8	41,999	a-b	73,253	4 DEH
	b	1 1/4	45,007	b-c	158,707	"
D	c	1 3/8	43,109	c-d	238,768	"
	d	1 1/8	32,090	d-e	340,323	6 DEH
	e	1 1/4	33,786	e-f	430,028	"
		Mast Weight 170.55 kips			Leg Spacing 10 ft	

Table 20 (Continued)

Tower Data For Figure 42

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	37,257	a-b	67,138	4 DEH
	b	1 1/4	35,769	b-c	131,985	"
E	c	1 3/8	37,698	c-d	198,176	"
	d	1 1/8	29,023	d-e	291,926	6 DEH
	e	1 1/4	33,052	e-f	381,818	"
		Mast Weight 135.39 kips		Leg Spacing 6 ft		
	a	1 1/8	38,145	a-b	68,283	3½ DEH
	b	1 1/4	38,055	b-c	135,144	"
E	c	1 3/8	40,391	c-d	203,195	"
	d	1 1/8	31,293	d-e	300,854	6 DEH
	e	1 1/4	35,753	e-f	395,883	"
		Mast Weight 136.06 kips		Leg Spacing 8 ft		
	a	1 1/8	39,064	a-b	69,467	3½ DEH
	b	1 1/4	40,442	b-c	145,453	"
E	c	1 3/8	43,178	c-d	223,788	"
	d	1 1/8	33,644	d-e	334,194	6 DEH
	e	1 3/8	39,147	e-f	441,484	"
		Mast Weight 167.92 kips		Leg Spacing 10 ft		

Table 21

Tower Data For Figure 43

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	53,619	a-b	93,970	5 DEH
	b	1 1/4	51,932	b-c	203,969	"
A	c	1 1/4	35,350	c-d	279,182	"
	d	1	23,324	d-e	338,853	"
	e	1 1/8	21,712	e-f	377,728	"
		Mast Weight 131.30 kips		Leg Spacing 6 ft		
	a	1 1/8	55,879	a-b	97,126	5 DEH
	b	1 3/8	57,058	b-c	214,674	"
A	c	1 1/4	37,999	c-d	294,129	"
	d	1 1/8	25,881	d-e	357,974	"
	e	1 1/4	23,228	e-f	398,767	"
		Mast Weight 138.44 kips		Leg Spacing 8 ft		
	a	1 1/8	58,217	a-b	100,394	5 DEH
	b	1 3/8	61,048	b-c	231,329	"
A	c	1 1/4	40,730	c-d	320,891	"
	d	1 1/8	27,721	d-e	393,059	"
	e	1 1/4	24,804	e-f	439,651	"
		Mast Weight 170.30		Leg Spacing 10 ft		

Table 21 (Continued)

Tower Data For Figure 43

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	50,655	a-b	89,836	5 DEH
	b	1 1/4	48,512	b-c	191,769	"
B	c	1 1/4	36,271	c-d	267,149	"
	d	1 1/8	26,229	d-e	334,547	"
	e	1 1/4	25,328	e-f	382,041	"
		Mast Weight 131.30 kips			Leg Spacing 6 ft	
	a	1 1/8	52,616	a-b	92,511	6 EH
	b	1 1/4	51,898	b-c	194,247	"
B	c	1 1/4	38,964	c-d	268,258	"
	d	1 1/8	28,182	d-e	334,080	5 DEH
	e	1 1/4	27,190	e-f	384,064	"
		Mast Weight 121.08 kips			Leg Spacing 8 ft	
	a	1 1/8	54,645	a-b	95,404	5 DEH
	b	1 1/4	55,507	b-c	217,110	"
B	c	1 1/4	41,753	c-d	307,806	"
	d	1 1/8	30,207	d-e	388,726	"
	e	1 3/8	28,944	e-f	446,902	"
		Mast Weight 170.30 kips			Leg Spacing 10 ft	

Table 21 (Continued)

Tower Data For Figure 43

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	47,617	a-b	85,600	5 DEH
	b	1 1/4	45,666	b-c	182,061	"
C	c	1 1/4	37,896	c-d	260,902	"
	d	1 1/8	28,475	d-e	335,671	6 DEH
	e	1 3/8	29,064	e-f	400,092	"
		Mast Weight 147.08 kips		Leg Spacing 6 ft		
	a	1 1/8	49,264	a-b	87,895	4 DEH
	b	1 1/4	48,849	b-c	183,898	"
C	c	1 1/4	40,709	c-d	261,303	"
	d	1 1/8	30,620	d-e	334,436	5 DEH
	e	1 3/8	31,185	e-f	393,946	"
		Mast Weight 120.61 kips		Leg Spacing 8 ft		
	a	1 1/8	50,969	a-b	90,272	4 DEH
	b	1 1/4	52,146	b-c	196,854	"
C	c	1 3/8	44,754	c-d	284,657	"
	d	1 1/8	32,843	d-e	367,155	5 DEH
	e	1 3/8	33,388	e-f	434,652	"
		Mast Weight 152.47 kips		Leg Spacing 10 ft		

Table 21 (Continued)

Tower Data For Figure 43

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	44,467	a-b	81,214	5 DEH
	b	1 1/4	43,836	b-c	170,405	"
D	c	1 3/8	40,606	c-d	254,347	"
	d	1 1/8	29,875	d-e	333,775	6 DEH
	e	1 3/8	31,318	e-f	404,548	"
		Mast Weight 148.39 kips			Leg Spacing 6 ft	
	a	1 1/8	45,779	a-b	83,040	4 DEH
	b	1 1/4	46,805	b-c	173,317	"
D	c	1 3/8	43,527	c-d	255,037	"
	d	1 1/8	32,134	d-e	333,175	6 DEH
	e	1 3/8	33,650	e-f	407,341	"
		Mast Weight 138.69 kips			Leg Spacing 8 ft	
			Leg Spacing 10 ft			
D	With 1 1/8 inch top guys, no commercial size of wire rope was available which would control the bending of the mast within the limit set without adjusting the length of the guys.					

Table 21 (Continued)

Tower Data For Figure 43

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
			Leg Spacing 6 ft			
E	With 1 1/8 inch top guys, no commercial size of wire rope was available which would control the bending of the mast within the limit set without adjusting the length of the guys.					
			Leg Spacing 8 ft			
E	With 1 1/8 inch top guys, no commercial size of wire rope was available which would control the bending of the mast within the limit set without adjusting the length of the guys.					
			Leg Spacing 10 ft			
E	With 1 1/8 inch top guys, no commercial size of wire rope was available which would control the bending of the mast within the limit set without adjusting the length of the guys.					

Table 22

Tower Data For Figure 44

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	48,152	a-b	81,587	5 DEH
	b	1 3/8	49,151	b-c	179,666	"
A	c	1 3/8	34,980	c-d	248,531	"
	d	1	22,706	d-e	307,493	"
	e	1 1/8	20,749	e-f	345,313	"
		Mast Weight 131.30 kips		Leg Spacing 6 ft		
	a	1 1/8	50,145	a-b	84,156	6 EH
	b	1 3/8	52,661	b-c	182,448	"
A	c	1 3/8	37,471	c-d	250,051	"
	d	1	24,450	d-e	307,666	5 DEH
	e	1 1/4	23,052	e-f	348,460	"
		Mast Weight 119.58 kips		Leg Spacing 8 ft		
	a	1 1/8	52,208	a-b	86,814	6 EH
	b	1 3/8	56,295	b-c	197,586	"
A	c	1 3/8	40,051	c-d	274,794	"
	d	1	26,258	d-e	340,761	5 DEH
	e	1 1/4	24,618	e-f	387,353	"
		Mast Weight 151.44 kips		Leg Spacing 10 ft		

Table 22 (Continued)

Tower Data For Figure 44

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	45,539	a-b	78,222	5 DEH
	b	1 1/4	44,538	b-c	169,763	"
B	c	1 1/4	34,529	c-d	238,890	"
	d	1	24,538	d-e	305,318	"
	e	1 1/4	25,052	e-f	352,812	"
		Mast Weight 131.30 kips		Leg Spacing 6 ft		
	a	1 1/8	47,268	a-b	80,449	4 DEH
	b	1 3/8	48,951	b-c	170,989	"
B	c	1 3/8	38,113	c-d	238,227	"
	d	1	26,439	d-e	305,320	5 DEH
	e	1 1/4	26,897	e-f	352,540	"
		Mast Weight 119.38 kips		Leg Spacing 8 ft		
	a	1 1/8	49,058	a-b	82,754	4 DEH
	b	1 3/8	52,216	b-c	184,398	"
B	c	1 3/8	40,719	c-d	260,731	"
	d	1 1/8	29,151	d-e	334,847	5 DEH
	e	1 1/4	28,812	e-f	391,767	"
		Mast Weight 151.15 kips		Leg Spacing 10 ft		

Table 22 (Continued)

Tower Data For Figure 44

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	42,858	a-b	74,774	4 DEH
	b	1 1/4	41,877	b-c	153,465	"
C	c	1 3/8	36,915	c-d	218,640	"
	d	1 1/8	27,278	d-e	286,519	5 DEH
	e	1 1/4	27,853	e-f	341,680	"
		Mast Weight 113.46 kips		Leg Spacing 6 ft		
	a	1 1/8	44,311	a-b	76,643	4 DEH
	b	1 1/4	44,750	b-c	161,957	"
C	c	1 3/8	39,525	c-d	232,584	"
	d	1 1/8	29,335	d-e	305,717	5 DEH
	e	1 3/8	30,768	e-f	365,227	"
		Mast Weight 120.61 kips		Leg Spacing 8 ft		
	a	1 1/8	45,815	a-b	78,578	4 DEH
	b	1 1/4	47,725	b-c	173,691	"
C	c	1 3/8	42,227	c-d	253,285	"
	d	1 1/8	31,468	d-e	335,783	5 DEH
	e	1 3/8	32,944	e-f	403,280	"
		Mast Weight 152.47 kips		Leg Spacing 10 ft		

Table 22 (Continued)

Tower Data For Figure 44

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	40,079	a-b	71,203	4 DEH
	b	1 1/4	40,067	b-c	146,740	"
D	c	1 3/8	38,183	c-d	216,101	"
	d	1 1/8	28,462	d-e	289,583	6 DEH
	e	1 3/8	30,813	e-f	360,357	"
		Mast Weight 131.55 kips		Leg Spacing 6 ft		
	a	1 1/8	41,237	a-b	72,690	4 DEH
	b	1 1/4	42,737	b-c	152,555	"
D	c	1 3/8	40,886	c-d	226,035	"
	d	1 1/8	30,617	d-e	304,172	5 DEH
	e	1 3/8	33,111	e-f	370,011	"
		Mast Weight 121.60 kips		Leg Spacing 8 ft		
	a	1 1/8	42,434	a-b	74,229	4 DEH
	b	1 1/4	45,501	b-c	162,656	"
D	c	1 3/8	43,685	c-d	245,297	"
	d	1 1/8	32,851	d-e	333,158	5 DEH
	e	1 3/8	35,496	e-f	407,685	"
		Mast Weight 153.46 kips		Leg Spacing 10 ft		

Table 22 (Continued)

Tower Data For Figure 44

Guy Arrangement	Point	Guy Size in.	Maximum Tension lbs	Length	Maximum Load lbs	Leg Size in.
	a	1 1/8	37,718	a-b	68,172	4 DEH
	b	1 1/4	36,322	b-c	136,207	"
E	c	1 3/8	38,318	c-d	205,214	"
	d	1 1/8	29,802	d-e	285,644	6 DEH
	e	1 3/8	34,788	e-f	367,535	"
		Mast Weight 135.39 kips			Leg Spacing 6 ft	

Leg Spacing 8 ft

E — With 1 1/8 inch top guys, no commercial size of wire rope was available which would control the bending of the mast within the limit set without adjusting the length of the guys.

Leg Spacing 10 ft

E — With 1 1/8 inch top guys, no commercial size of wire rope was available which would control the bending of the mast within the limit set without adjusting the length of the guys.

APPENDIX G

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APPENDIX H

VITA

VITA

William Joseph Lnenicka was born in Hay Springs, Nebraska, on October 16, 1922. He attended elementary and secondary schools there, graduating in 1940.

After two years attendance at Nebraska State College, he enlisted in the Infantry, Army of the United States, in September, 1942, and was released from active duty in the Signal Corps, in September, 1946. He has remained in the United States Army Reserve, Corps of Engineers, and is presently taking the Command and General Staff course through the Army Reserve schools.

From 1946 to 1949 he attended the University of Nebraska, where he received the degree Bachelor of Science in Civil Engineering. He then taught as an instructor in the Department of Civil Engineering at the University of Nebraska until 1951. In 1952, he became an instructor in the Department of Civil Engineering at Kansas State University, where he received the degree Master of Science in Civil Engineering in 1953.

Since 1954, he has taught as an Assistant Professor of Engineering Mechanics at the University of Oklahoma, at Louisiana State University, and at the Georgia Institute of Technology.

He is a member of the honorary societies Blue Key, Sigma Tau, Phi Kappa Phi, and Sigma Xi. He is a member of the professional societies American Association of University Professors, American Society for Engineering Education, and the Society of American Military Engineers.

He is a registered professional engineer in the State of Oklahoma.

In 1959, he was the recipient of a National Science Foundation Science Faculty Fellowship for twelve months. This award was granted for advanced study in Civil Engineering at the Georgia Institute of Technology.

In 1961, he was appointed Associate Professor of Engineering Mechanics at the Georgia Institute of Technology.