DESCRIPTION OF B GUYED TOWER

CONTENTS PAGE

1. GENERAL 1
2. FOUNDATIONS AND ANCHORS . . . 1
3. LOT REQUIREMENTS 1
4. STRUCTURAL FEATURES 2
5. WEIGHT 2
6. WIND LOADING 4
7. ANTENNA LOADING AND STABILITY . 4
8. ANTENNA MOUNTING 4
9. LIGHTING 6
10. PAINTING 6
11. DESIGN FACTORS AND LIMITATIONS . 6

1. GENERAL

1.01 This section describes the B Guyed Tower, which is primarily intended for use with light route microwave systems. It has been reissued primarily to change the minimum lot sizes, add information on blind sectors for antennas, the use of 10 x 15 foot reflectors and a discussion of nonstandard tower heights. A number of other changes, mostly of an editorial nature, have also been made. Changes are indicated in the usual manner.

2. FOUNDATIONS AND ANCHORS

2.01 The B Guyed Tower is supported by reinforced concrete foundations described in Section AG25.210. Anchor bolts, guy rods, and anchor rods used with the guying system and foundations are parts of the B Guyed Tower Anchor, which is to be ordered separately.

2.02 Foundations and anchors must be equipped with the B Guyed Tower Ground, to protect them against lightning damage. It is not shipped with the tower and must be ordered separately.

3. LOT REQUIREMENTS

3.01 The amount of land or the size of lot required is determined primarily by the height of the tower. Land requirements are also affected by the slope (if any) of the ground.

3.02 Where the terrain is level, the size of the lot must be large enough to accommodate three radii of length equal to the height of the tower plus 3 feet, spaced 120 degrees apart and oriented in the direction of the guys. On level ground, the distance from the center of the tower to the point where the guy rod enters the ground is approximately equal to the height of the tower less 10 feet. Allowance must also be made, however, for the anchors to which the guy loads are transmitted and further for the angle of shear of the soil.

3.03 The ***minimum*** sizes of rectangular lot which will meet the previously stated requirements on level ground are as follows:

TOWER HEIGHT (FEET)	LOT SIZE (FEET)
80	123 x 142
100	154 x 178
120	184 x 212
140	214 x 247
160	244 x 282
180	275 x 317
200	305 x 352
220	334 x 386
240	364 x 420
260	394 x 455
280	424 x 489
300	454 x 524

The above dimensions must be increased or decreased for sloping terrain as explained in 3.04. The maximum slope should preferably not exceed 3 degrees.

3.04 Where the terrain is not level, the length of the three radii mentioned above must be increased or decreased by one foot for each foot of difference in elevation between the center and the outer extremity so as to maintain a 45-degree angle of elevation for the top guys.

3.05 It is not absolutely necessary, of course, to employ a solid rectangular lot. If the lot involves land in agricultural use, for example, substantial savings in land costs may be possible by obtaining a relatively small lot for the tower foundation and building (eg, 30 feet by 30 feet) and small individual lots for the anchors. In such cases it will often be desirable to fence in the anchor locations in order to →avoid possible damage to guys by farm machinery. It will generally be advisable to obtain a good idea of the kind of agricultural machinery which may be used in the vicinity. Fencing should be placed so as to protect all parts of the guys which will be low enough to be subject to damage by the tallest farm machinery plus an allowance for personnel riding on top of such machinery, if this is possible.

4. STRUCTURAL FEATURES

4.01 The B Guyed Tower is a single-guyed mast which is fabricated of galvanized steel. It is of triangular cross section, 4 feet on a side, and comes in height sizes from 80 feet to 300 feet in 20-foot increments. It is shipped knocked down to be field-assembled, using bolts only. The general appearance of the tower is shown in Fig. 1.

4.02 The tower rests upon a single support and depends entirely upon the guys for its ability to withstand overturning or twisting forces. Guys extend from the tower in three directions, spaced 120 degrees apart. The top section of the tower is equipped with torque arms, to provide increased leverage for the top set of six guys. The outer end of each torque arm is 15 feet from the outer end of the other torque arms.

4.03 All guys are 19-wire extra-high-strength galvanized strand. Towers 160 feet high and smaller employ 1/2-inch diameter strand (breaking strength 26,700 lbs) ; all others employ 9/16-inch diameter strand (breaking strength 33,700 lbs). The maximum design tension for the 1/2-inch strand is 10,680 lbs; the maximum design tension for the 9/16-inch diameter strand is 13,480 lbs. All guys are equipped with →turnbuckles, in order to make adjustments in →guy tensions.

4.04 Guys are attached at the following heights above ground, (including an allowance of 6 inches above ground for the foundation pier).

NOMINAL HEIGHT OF TOWER	GUY ATTACHMENT HEIGHT BOTTOM	MIDDLE	TOP
(All Heights Are Given to the Nearest Foot)			
80	—	—	66
100	41	—	86
120	61	—	106
140	61	—	126
160	61	—	146
180	81	—	166
200	81	—	186
220	61	121	206
240	61	141	226
260	81	161	246
280	81	181	266
300	81	181	286

Note: The middle guys and top guys are always installed with a lead/height ratio of 1.00 (ie, an angle of 45 degrees). The angle of the lower guys varies.

5. WEIGHT

5.01 The approximate weight of the various sizes of towers, exclusive of lighting fixtures, antennas, anchor bolts, and other appurtenances or auxiliary equipment, is as follows:

HEIGHT (FEET)	WEIGHT (LBS)
80	6,500
100	7,400
120	8,100
140	8,750
160	9,450
180	10,850
200	11,900
220	12,800
240	13,600
260	15,000
280	16,100
300	17,100

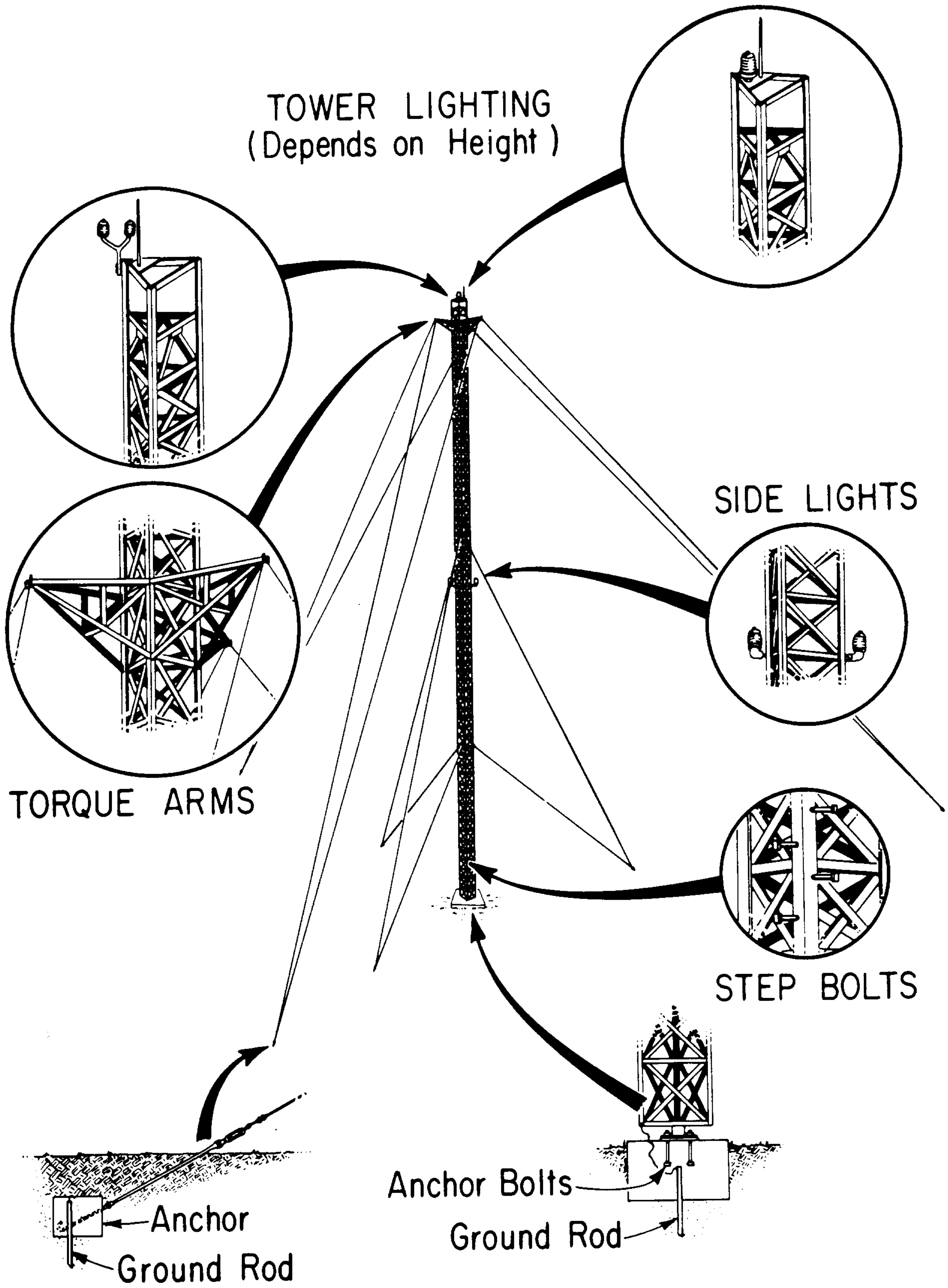
TOWER LIGHTING
(Depends on Height)
SIDE LIGHTS
TORQUE ARMS
STEP BOLTS
Anchor Bolts
Ground Rod
Anchor
Ground Rod

Fig. 1

6. WIND LOADING

6.01 The B Guyed Tower is designed to withstand a wind pressure of 40 lbs per square foot while carrying a full complement of antennas, etc, as listed in 7.01. This pressure roughly corresponds to a velocity of about 100 miles/hour. Design stresses under this wind loading are such as to provide a safety factor of at least 1.65, based upon the yield point of the material.

7. ANTENNA LOADING AND STABILITY

7.01 The B Guyed Tower is designed to support the System standard reflectors up to 8 x 12 feet in size and parabolic dishes not over 10 feet in diameter. Parabolic antennas should not be used on towers over 120 feet high, however. Otherwise any combination of reflectors and antennas may be attached, but not more than one antenna or reflector on each leg. B Guyed Towers higher than 120 feet should not be equipped with parabolic antennas. Nonstandard antennas or reflectors of the same physical size may also be used, although it may be necessary to modify the antenna mountings in some cases.

7.02 The use of 10 x 15 foot reflectors on the B Guyed Tower is not recommended. Two reflectors can be installed if the angle between them is 167 degrees or more, but the stability of the tower becomes marginal. Modifications of the tower are usually necessary if the angle is decreased unless a lesser degree of stability can be tolerated. Where the use of the larger reflectors appears desirable, the heavier E Guyed Tower is recommended.

7.03 B Guyed Towers carrying any of the recommended antenna or reflector loads are designed to provide a mechanical stability of ± 1/4 degree in tilt and ± 1/2 degree in twist under a wind loading of 20 lbs/square foot (about 70 miles/hour). This degree of stability requires a terrain where the slope from the base of the tower will not exceed 3 degrees. For terrain sloping more than 3 degrees, the above deflections will increase (eg, for a 6-degree slope, deflections will increase about 10%).

7.04 It should be noted that the B Guyed Tower provides effective stability only at the top level of guys (ie, at the torque arms). Resistance against twisting forces diminishes rapidly from the level of the torque arms, since the base of the tower rests on what approximates a ball-and-socket joint and lower levels of guying are relatively ineffectual in controlling twist.

7.05 When considering deflection of the B Guyed Tower, it should be noted there are two separate and distinct effects. One is the movement of the tower as a unit as the guys stretch under load. The other is the bending of the tower between guy points. Both of these effects are brought into play by wind pressure acting on the tower and its appurtenances. The wind pressure on the antennas or reflectors represents a fairly concentrated load and they are therefore placed as close as possible to the level of attachment of the top guys. This minimizes the bending moment between guy points and the deflection which is caused by it. In considering the deflection of antennas or reflectors at locations other than standard, it should also be noted that the tower should be considered as a continuous beam on flexible supports.

8. ANTENNA MOUNTING

8.01 Facilities are available for mounting the appurtenances described in 7.01, but these are not furnished with the tower. The recommended locations for mounting antennas and reflectors are on the three legs, just above the level of the torque arms.

8.02 Using the standard mounting arrangement, the center of the 8 x 12 foot reflector will be approximately 6 feet below the top of the tower; the center of the 6 x 8 foot reflector will be approximately 7-1/2 feet below the top of the tower; the center of the antennas will be 9 feet from the top of the tower.

8.03 It will be necessary to exercise some care in orienting the tower, because of the "blind" sectors which occur due to the mechanical limitations of the mountings and reflector adjustment mechanisms. As shown in Fig. 2, three blind sectors 40 degrees wide and spaced 120 degrees apart occur when using 8 x 12 foot reflectors. Similar blind sectors of 30 degrees and 52 degrees occur when using 8- and 10-foot

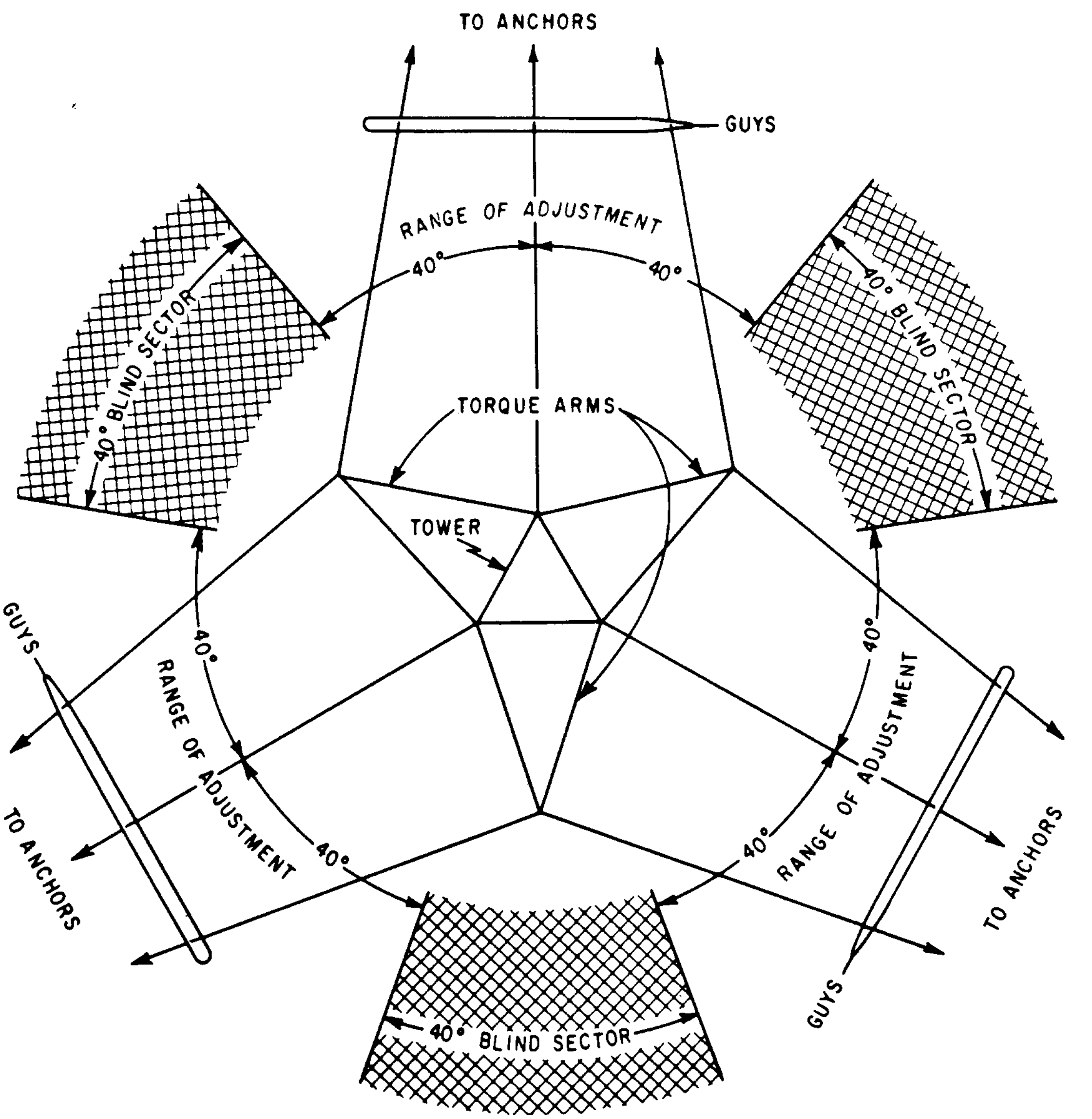

Fig. 2 – Azimuth Limitations for 8 x 12 Foot Reflectors Mounted on B Guyed Towers

antennas, respectively. The above-mentioned limitations need not affect the orientation of minimum size rectangular lots described in Part 3 of this section, however, since the tower can be oriented on the lot in either of two positions which are 180 degrees apart.

8.04 Occasionally, transmission considerations may require mounting antennas or reflectors at other than the standard locations. As indicated in Part 7 of this section, this will entail increased deflection and twist, unless the tower is modified. The Western Electric Company has established a Tower Group (part of their Systems Standard Engineering — Dept. 155 — North Andover, Mass.) to handle tower modi- the B Guyed Tower and has access to the design criteria and calculations, they are in a somewhat better position to do this work than are outside consultants. Information necessary to enable modifications to be worked out should include the size of each antenna or reflector, its height of attachment, azimuth bearing, and nominal tower height.

8.05 Occasionally, antenna heights are specified which appear to require a nonstandard height tower. Usually, however, the result of raising the antenna a few feet will not be too serious. Antenna heights should not be changed without the concurrence of the responsible radio people, since transmission may be impaired in some cases. It should be noted that nonstandard height towers cost more than the next larger size of standard tower, because of special engineering and special handling by the tower manufacturer. Nonstandard size towers also involve some delay in shipping.

9. LIGHTING

9.01 Air obstruction lighting for the B Guyed Tower is usually required for towers 160 feet high or taller but may be required for any height, depending upon its location with respect to airports. Detailed requirements for air obstruction lighting and marking of radio towers is contained in Part 17 of the Rules and Regulations of the Federal Communications Commission.

9.02 Lighting for the B Guyed Tower must be ordered separately, and is available in three types as follows:

(a) F.C.C. 17.24 Top light only.

(b) F.C.C. 17.25 Top flashing beacon light and one set of side lights halfway up the tower.

(c) F.C.C. 17.26 Top flashing beacon light and two sets of side lights at one-third and two-thirds tower height.

9.03 All lighting wiring on the tower is in conduit which is fastened to the tower by metal tapes. Sufficient wire and conduit is supplied to bring the wiring from the lighting fixtures to a junction box at the base of the tower. Conduit and wiring from the base of the tower to the lighting control box inside the building must be supplied locally. Other electrical needs at or near the base of the tower should also be considered in connection with these conduit and wire requirements (eg, antenna deicers, floodlighting, etc).

10. PAINTING

10.01 Painting to increase visibility for air traffic is required by Part 17 of F.C.C. regulations under the same conditions that require air obstruction lighting. Under the present rules, this takes the form of alternate equal bands of aviation surface orange (Federal Specification TT-P-59) and outside white (Federal Specification TT-P-102). The width of the bands shall be approximately one-seventh the height of the structure, provided the widths do not exceed 40 feet. The top and bottom bands must be aviation surface orange. Painting is usually done by the tower erector, and the erection contract should so specify.

11. DESIGN FACTORS AND LIMITATIONS

11.01 Good engineering practice and safe design considerations have led to the adoption of certain limitations which have been followed in the design of the B Guyed Tower. Some of these have been more or less developed by the steel tower fabricating industry. Others have been developed by the American Institute of Steel Construction. Some are peculiar to the Bell System.