BELL SYSTEM PRACTICES
Outside Plant Construction and Maintenance

SECTION G23.120
Issue 1, February, 1933
Standard

GUYING
OPEN WIRE LINES

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1. POSITION OF GUYS IN OPEN WIRE LINES

1.01 In general attach side guys to poles supporting open wire as indicated in the following tables.

Number of Side Guys	Place Side Guy Under:
1	2nd. Crossarm
2	2nd. and 4th. Crossarm
3	2nd. 4th. and 6th. Crossarm
4	2nd. 4th. 6th. and 8th. Crossarm

Note: The location of side guys under the even-numbered arms rather than under the odd-numbered arms is generally considered preferable, inasmuch as the amount of interference between the conductors and guys is thereby kept to a minimum. In some cases, however, it may be advantageous to place the side guys under the odd-numbered arms. For example, in the case of guys crossing over a highway to a stub additional ground clearance can thereby be obtained without

introducing conductor interference. Where local conditions are such that advantages can be gained by shifting the point of attachment of the side guys to below the odd-numbered arms this may be done.

1.02 Attach head guys in accordance with the following:

Number of Head Guys	Place Head Guy Under:
1	1st Crossarm
2	1st and 3rd Crossarm
3	1st, 3rd and 5th Crossarm
4	1st, 3rd, 5th and 7th Crossarm

Note: If the side guys are placed in accordance with the above note, place the head guys under the second, fourth and sixth crossarms. Where the smaller sizes of cedar poles are used, if desired the upper head and side guys can be placed under the first arm.

1.03 Guys for lines having 8-inch spacing between line wires.

(a) When respacing existing wire from 12-inch to 8-inch separation between the two wires of a pair, existing side guys on the lead may make contact with the respaced wires. Guy clearances from the line wires can be obtained by moving the point of attachment of the guy to the pole up or down the pole the desired amount.

(b) Where the attachment is moved up the pole and the length of the guy strand is inadequate to permit wrapping around the pole in a standard manner a bent thimble eye bolt should be placed in the pole at the desired location and the existing guy strand attached to it. This procedure will avoid replacing the guy strand because of insufficient length.

(c) Where new side guys are placed on a line, lead over height ratio of 1 will, in general, give sufficient clearances between guy strands and line wires on 8-inch spaced circuits.

2. SIZES OF GUYS

2.01 The number of wires for which guying shall be placed or the sizes of guys to be placed will usually be shown on the detail plans. This may be for:

(a) The existing wires on the line.

(b) The immediate requirements of the line.

(c) The ultimate requirements of the line.

Note: All guys placed for the existing or proposed wires on the line shall be arranged so as to conform with the guying that will be required for the ultimate capacity of the line.

2.02 Determine the size of the guy required by reference to the Guy Rule except:

(a) On lines supporting 2 or 4 wires, use 2,200 pound strand or Galv. Wire for guys.

(b) On all Class A toll lines (see paragraph 6.04) or on other lines supporting more than 20 wires do not use smaller than 6,000 pound strand.

2.03 Where the size of guy as indicated by the Guy Rule is greater than 6,000 pounds and the line supports three or more crossarms of wires:

(a) Two 6,000 pound strands may be placed in preference to one 10,000 pound strand particularly on Northern White Cedar poles. If a 10,000 pound strand is required for each two crossarms, as at dead-ends, use only one guy for each pair of crossarms.

(b) One 6,000 pound and one 10,000 pound strand may be placed in preference to one 16,000 pound strand, particularly on northern white cedar poles. If a 16,000 pound guy is required for each two crossarms, as at dead-ends, use only one guy for each pair of crossarms.

(c) Do not use 6,000 pound and 16,000 pound guys on the same pole, unless one is for a cable and the other for open wire (see paragraph 7.01, Section G23.115).

2.04 Where the existing anchors will not accommodate the guying required, when placing additional wires, additional anchors and rods should be placed which will permit the remainder of the guying for the ultimate load to conform to the arrangements given above, that is install a double thimble rod if the existing anchors will not accommodate the new guying and two or more guys will be required ultimately.

3. GUYING CORNER POLES IN OPEN WIRE LINES

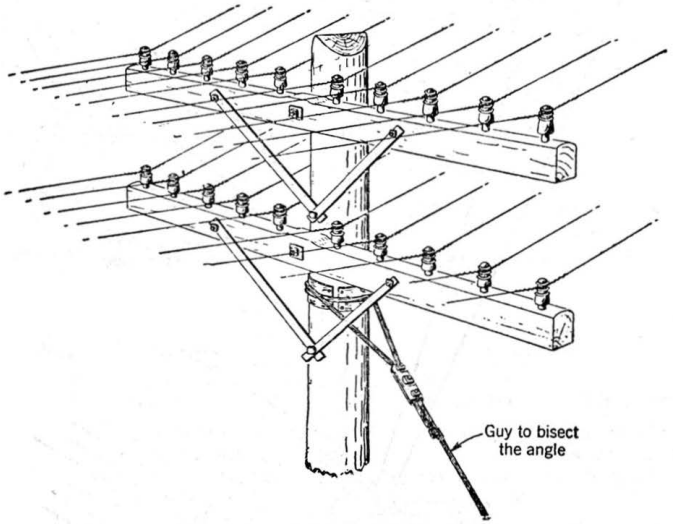
3.01 All corner poles on lines supporting open wire only, with a pull greater than indicated in the following table shall be guyed. In general, poles with less pull than shown shall not be guyed. On important toll lines, however, the limits specified for less than five arms may be decreased where justified due to local conditions such as severe wind exposures and swampy ground. Under such conditions the poles should be guyed for any pull that can be detected.

Ultimate Number of Wires or Crossarms on Pole	Guy Pole Where Pull is:
2 or 4 Wires	* 10 Feet or over
1 or 2 Crossarms	4 Feet or over
3 or 4 Crossarms	2 Feet or over
5 or 6 Crossarms	1 Foot or over
7 or more Crossarms	* *

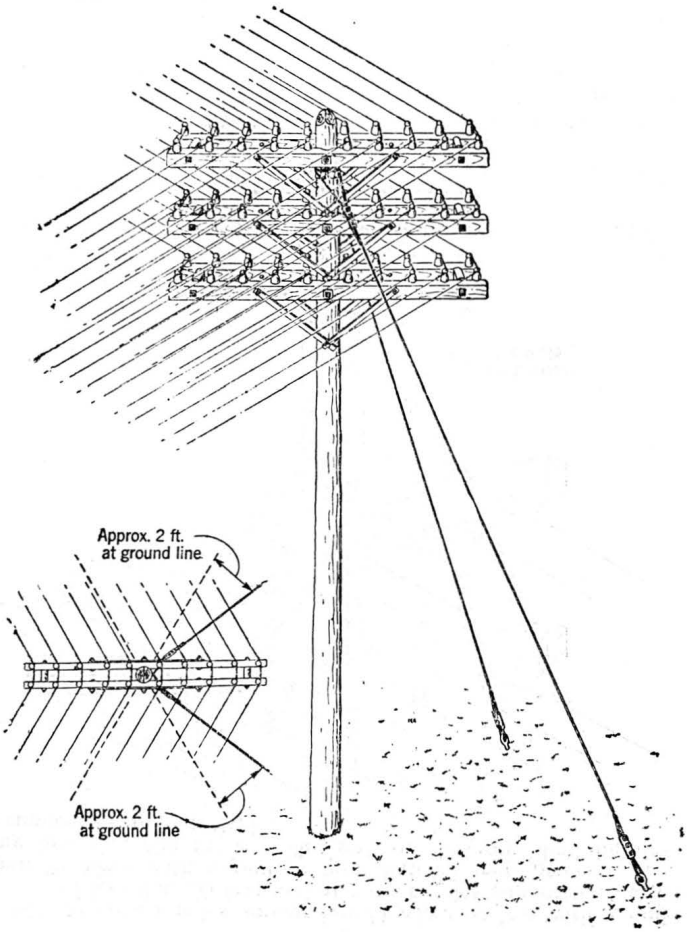
* Under certain soil conditions a guy may be required for a "Pull" of from 5 ft. to 10 ft.
* * Any "Pull" that can be detected.

Note: Unguyed corner poles should be ground braced where there is a tendency for the poles to be pulled over due to soil conditions.

3.02 At corner poles supporting 20 wires or less with a pull of less than 50 feet and at corner poles supporting more than 20 wires with a pull of less than 35 feet, place a side guy bisecting the angle. The size of the guy shall be determined by the Guy Rule.



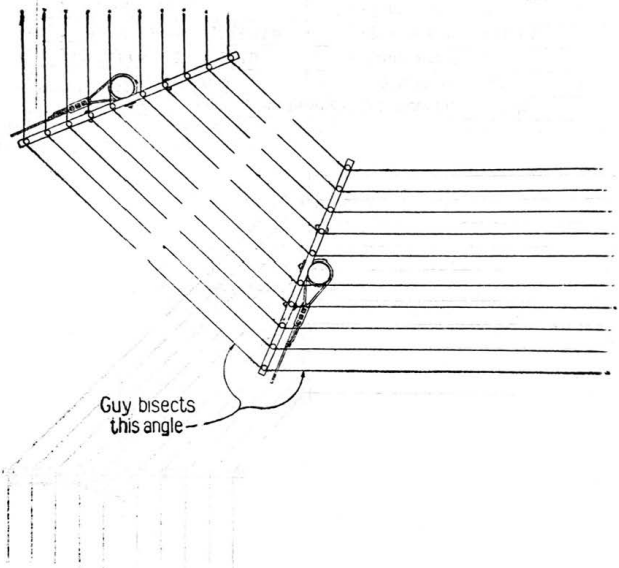
3.03 At corner poles supporting 20 wires or less with a pull of 50 feet or more and at corner poles supporting more than 20 wires with a pull of 35 feet or more place two head guys. Determine the size of each guy by the Guy Rule, considering pull on pole as 50 feet.



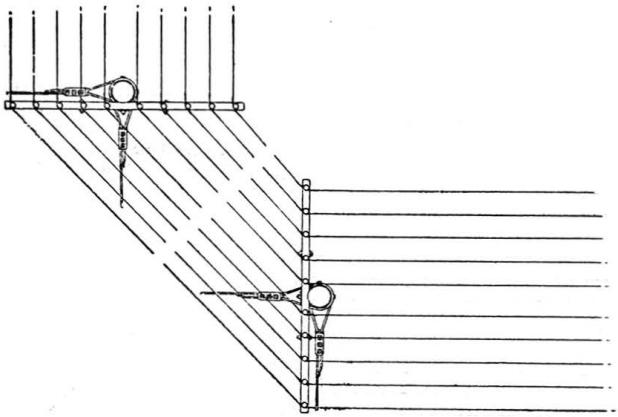
3.04 At right angle corners made on one pole, place two head guys. Place each guy in line with the lead it supports. Determine the strength of each guy by the Guy Rule, considering pull on pole as 50 feet.

3.05 At right angle corners made on two poles, place guys as follows:

(a) In lines supporting 20 wires or less, where practicable, side-guy each corner pole with a guy bisecting the angle as shown. Determine the size of each guy by the Guy Rule.



(b) Head-guy and side-guy each corner pole as shown where the line carries more than 20 wires and for other lines where it is impracticable to place a guy bisecting the angle. Place the head guys in line with the lead and the side guys at right angles to the lead. Determine the size of the side guys by the Guy Rule, considering each as bisecting the angle. The size of the head guys shall be as indicated in the following table:

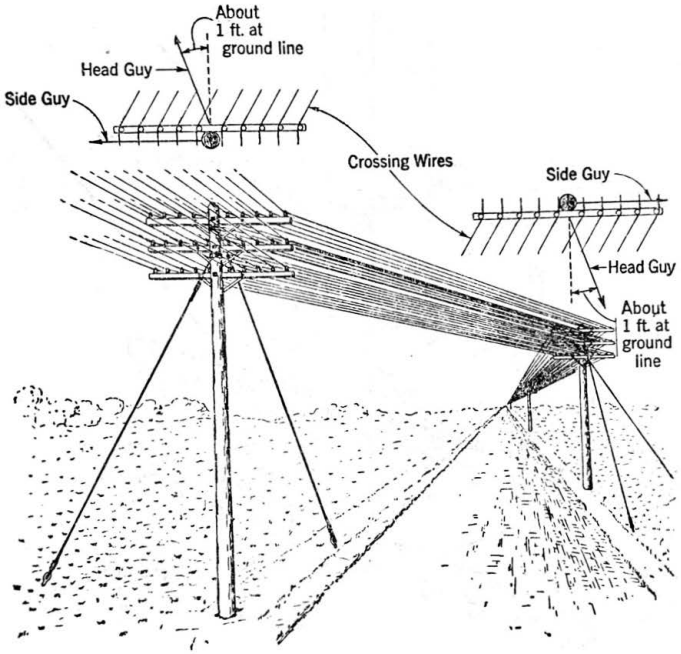


Size of Head Guy Required on Head and Side Guyed Corner Poles.	
Size of Side Guy	Size of Head Guy
1 - 2,200 Lb. or 1 - 6,000 Lb.	1 - Same size strand
1 - 10,000 Lb. or 1 - 16,000 Lb.	1 - Next size smaller strand
2 - Any size strand	*1 - Same size strand
3 or 4 - Any size strand	*2 - Same size strand

* If two or more strands of different size are used in the side guy, strands of the larger size shall be used for head guy.

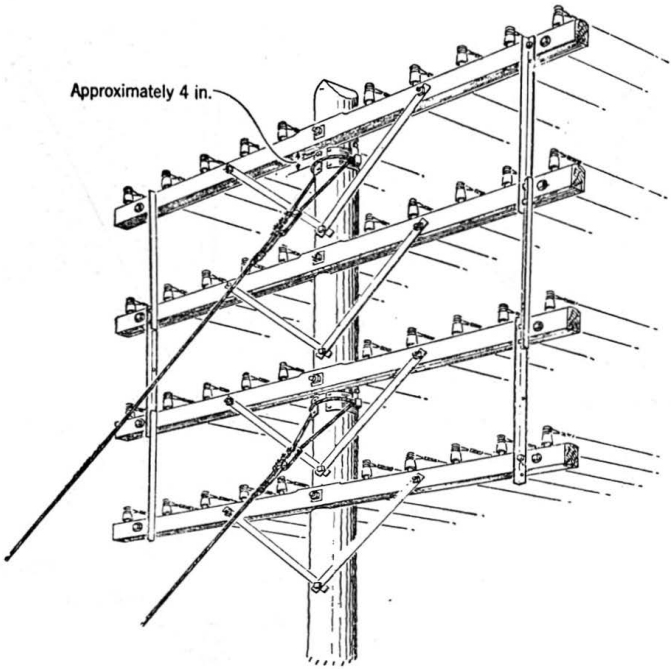
Note: $\frac{\text{Lead}}{\text{Height}}$ should be about 1 if practicable.

3.06 Reverse corners at road crossings shall be treated the same as separate corners in the line. Where, on account of right of way conditions, a side guy bisecting the angle cannot be installed, place a head and side guy. Place the head guy in line with the lead and the side guy at right angles to the lead. Determine the size of the side guy by the Guy Rule, considering it as bisecting the angle. The size of the head guy shall be as indicated in the table in Paragraph 3.05 b. Where practicable, place the head guys in from the lead about 1 foot as indicated.



4. TERMINATING POINTS

4.01 At terminal points in lines supporting open wire only, place head guys. Determine the sizes of the guys by the Guy Rule, considering it as an "Aerial Wire Dead End."



4.02 At points in a line supporting open wire only, where, due to wires being dead-ended or branching off, an unbalanced load exists, place head guys under the following conditions:

(a) Where the main lead consists of six or less through wires and the number of wires dead-ended or branching off is two or more, place a 203 galvanized wire or 2200-pound strand head guy for the branch lead and another similar guy for the dead-ended wires.

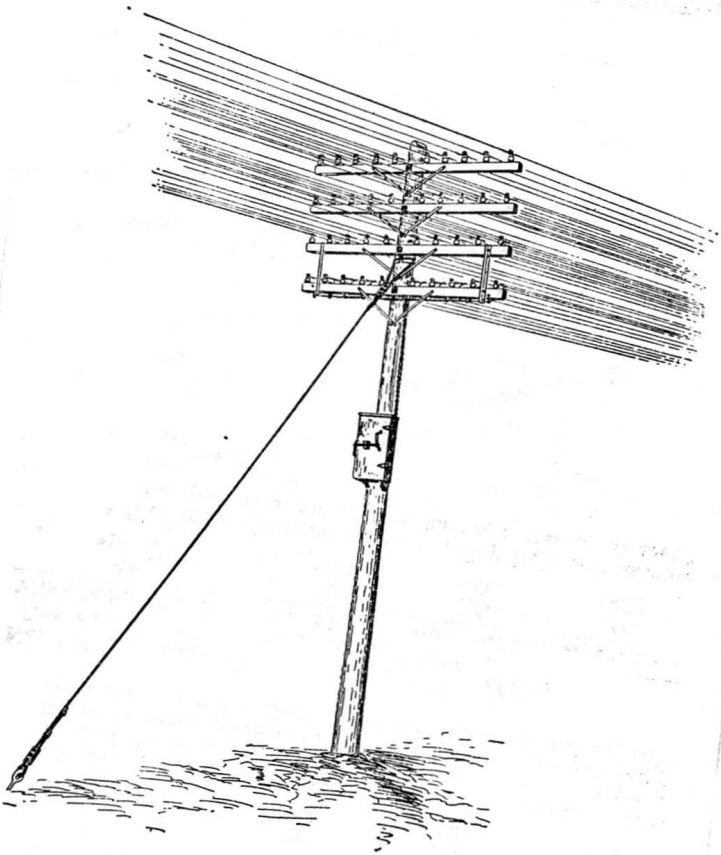
(b) Where the main lead consists of ten through wires and the number of wires dead-ended or branching off is four or more, place separate head guys of the following sizes for the wires dead-ended and those branching off.

No. of Wires Dead-Ended and No. of Wires in Side Lead	Lead Height of Guy		
	1 or More	Approx. 2/3	Approx. 1/2
4	203	203	203
6	203	2200	6000
10	6000	6000	6000

(c) Where main lead consists of 20 or more through wires and the number of wires dead-ended or branching off is six or more place separate head guys of the following sizes for the wires dead-ended and those branching off:

No. of Wires Dead-Ended and No. of Wires in Side Lead	Lead Height of Guy		
	1 or More	Approx. 2/3	Approx. 1/2
6	203	2200	6000
*10	6000	6000	6000

* "For more than ten wires, use Guy Rule and assume that pole is a corner pole having a pull of 50 feet."



5. POLE-TO-POLE GUYS

5.01 In general pole-to-pole guys are not considered desirable except in the case of exchange and rural lines that are to be extended and in other cases where it is impracticable to use anchor guys.

5.02 Existing pole-to-pole head guys adjacent to corner poles shall be removed:

(a) Where it becomes necessary to replace the pole.

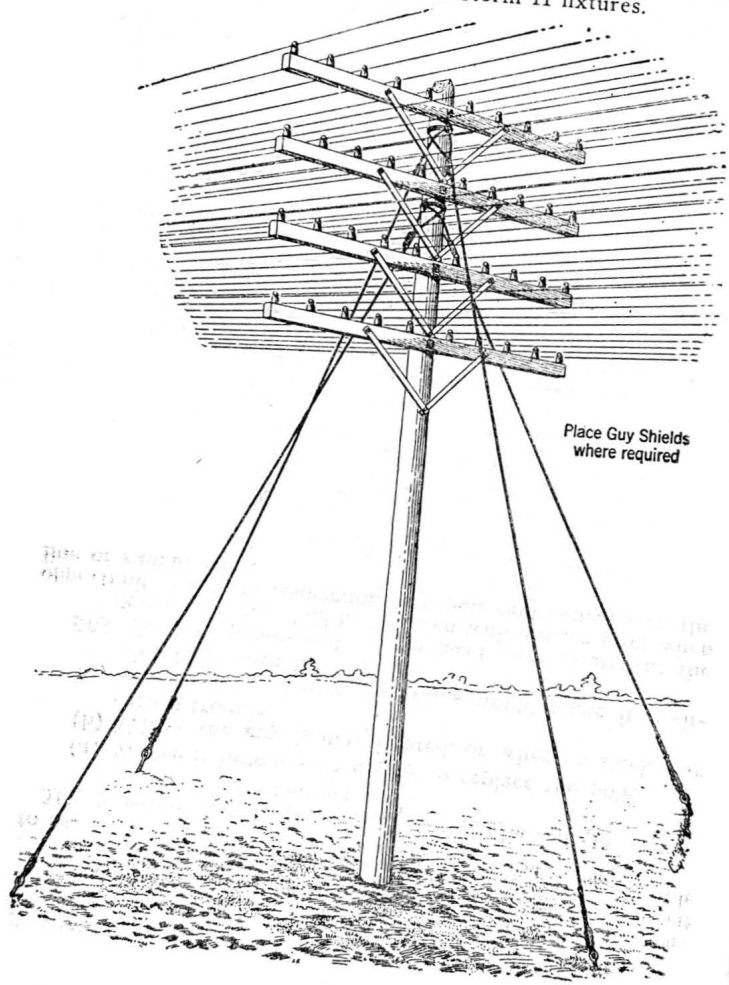
(b) Where the guy is deteriorated, or where a slack guy causes trouble.

(c) Where right of way conditions would make it desirable to remove the guy.

5.03 Existing pole-to-pole storm head guys located at the desired spacing shall be replaced with anchor guys when opportunity offers in connection with pole replacements on the line or similar work.

6. STORM GUYS

6.01 In general, place storm head guys only on poles which are storm side-guyed or on storm H fixtures.



6.02 Use the following sizes of strand for storm guys.

Ultimate Number of Crossarms	Storm Head Guys (Pounds)	Location	Storm Side Guys (Pounds)	Location
4 or less	1-6,000	Under 1st. arm	1-6,000	Under 2nd. arm
5 to 6 incl.	2-6,000 or *1-10,000	Under 1st and 3rd. arms Under 3rd. arm.	1-6,000	Under 2nd. arm
7 or more	2-10,000	Under 1st. and 5th. arm	2-6,000	Under 2nd. and 4th. arm.

*The placing of 2-6,000 Lb. guy strands for storm head guys is preferable to the use of 1-10,000 Lb. and 2-6,000 Lb. strands shall be used where practicable.

6.03 The amount of head guying which would be required for a single pole fixture should be distributed between the two poles of the "H" fixture and should be placed as follows:

No. of Crossarms	Storm Head Guys on each Pole	Location
4 or Less	1-6M	Under 1st Arm
5 or More	2-6M	Under 1st and 5th Arms

Note: Where H fixtures are located near streams, ditches and under similar conditions, the head guys on each pole of the fixture should be attached to a single anchor log which should be placed across the lead.

6.04 The frequency of storm guying in any line will depend on the class of the line, the severity of sleet, and wind conditions. In general, lines with a maximum of 10 wires need not be storm guyed. Lines are classified as Class A, B or C, in accordance with the provisions of Bell System Practices covering Pole Line Engineering and the classification of the line should be given in the detail plans.

6.05 The location of storm guys shall be shown on the detail plans. Straight sections only shall be storm-guyed. A straight section is defined as a section included between any two of the following poles:

(a) Corner pole having a pull of 15 feet or more.

(b) Terminal pole.

(c) Pole where one or more crossarms of wire terminate or branch off the line.

(d) Pole guyed for a railroad or river crossing, or long span crossing.

(e) Reverse corners, such as at road crossings, which do not form the end of a straight section should be considered as side storm guyed points when the guys bisect the angles and as storm side and head guyed points when both poles are side and head guyed.

6.06 The spacing of storm guyed points is as follows:

Normal Spacing of Storm Guys

Class of Line	Heavy Loading Areas No. of Spans		Medium Loading Areas No. of Spans		Light Loading Areas No. of Spans	
	Side Guys	Side and Head Guys	Side Guys	Side and Head Guys	Side Guys	Side and Head Guys
Class A						
2 Arms	20	40	40	80	—	80
3 "	—	20	—	40	—	80
4 "	10	20	20	40	40	80
5 "	—	10	—	20	—	40
6 "	—	10	10	20	20	40
7 "	5	10	—	10	—	20
Over 7 Arms	5	10	—	10	10	20
Class B						
2 Arms	40	80	—	80	—	80
3 "	—	40	40	80	—	80
4 "	20	40	40	80	40	80
5 "	—	20	—	40	40	80
6 "	10	20	20	40	—	40
7 "	—	10	—	20	20	40
Class C						
2 Arms	—	80				
3 "	40	80				
4 "	40	80				

Note: The spacing of storm guys is based on the number of crossarms, irrespective of the number of wires per arm. For example, a line having three eight-pin crossarms should be guyed similar to a line carrying three ten-pin crossarms.

6.07 The maximum length of section from which storm guys may be omitted is dependent upon the normal spacing of storm guys and should be governed by the following table.

Normal Spacing of Storm Guys No. of Spans		Max. Length of Section from which Storm Guys may be Omitted
Side Guys	Side and Head Guys	Spans
—	80	120
40	80	60
—	40	60
20	40	30
—	20	30
10	20	15
—	10	15
5	10	8

For example:

On a Class A line (Heavy Loading) supporting four crossarms, storm side guys shall be placed every 10th pole and storm head guys at every 20th pole. In a section of 35 spans in a line of this character the side guys would be placed at the 10th and 20th poles, leaving a fifteen-span unguyed section between the 20th and 35th poles. In a section of 36 spans side guys would be placed at the 10th, 20th and 30th poles, leaving a remaining section of 6 spans between the 30th and 36th poles. Storm head guys would also be placed at the 20th pole in each case.

6.08 The application of the spacing rules for storm guys, indicated in the table, shall be adjusted to special conditions as follows:

(a) If a storm guy falls normally on a pole in a well sheltered section, and the section of line immediately adjoining is more exposed, the location of the storm guys shall be moved to the more exposed section.

(b) Where road crossings are involved and it is practicable the storm guyed point should be located adjacent to the intersecting roadway.

(c) Where the right of way situation or construction difficulties make the normal location of the storm guys impracticable, they may be located on other poles.

(d) Corner poles not marking the end of a straight section shall be treated as follows:

(1) Where the storm guys fall normally within three spans of a corner pole with a pull of less than 15 feet, the location of the storm guys shall be moved to the corner pole. In general avoid locating storm H fixtures at corner positions.

(2) Determine the size of the guy required for the corner by means of the Guy Rule. If the size of guy indicated thereby is as large or larger than that required for storm guying, install the size of guy required by the Guy Rule.

(3) If there is a corner guy in place and guying of greater strength is required, replace the existing guy or add an additional guy as recommended in 2.03 above.

(4) If the size of guy required by the Guy Rule is smaller than that specified for a storm side guy, use a guy of the latter size.

(5) Place a guy of the size specified for storm guys opposite the corner guy.

(6) When storm side and head guys are required at a corner, place the head guys in line with the wire through which they pass.

(e) When the spacing of storm guys is changed to accommodate special conditions, the spacing beyond may be continued from the pole where the storm guy is placed or from the normal location for the storm guyed pole.

6.09 In general, storm guys shall be anchor guys or guy stub and anchor guys. Where impracticable to place side anchor guy, or guy stub and anchor, or when specified in the detail plans, "H" fixtures shall be used for storm side guys. In special cases, where necessary on account of right of way difficulties, push and pull braces may be substituted for storm side guys but they usually require irregular wire spacing and should be avoided as well as A fixtures where 8-inch wire spacing is involved.

7. GUYING AT GRADES

7.01 Place side guys on poles where there is a change in grade resulting in a down pull of such magnitude that "heavy" or "extra heavy" construction is required (See Section G21.120), covering grading of Pole Lines. The size and location of the side guys are shown in paragraph 6.02 above.

7.02 If the normal location for storm guys would be within three spans of the pole at the change in grade, omit the storm guys at the normal location and place them at the change in grade location.

8. GUYING AT STREET RAILWAY CROSSINGS

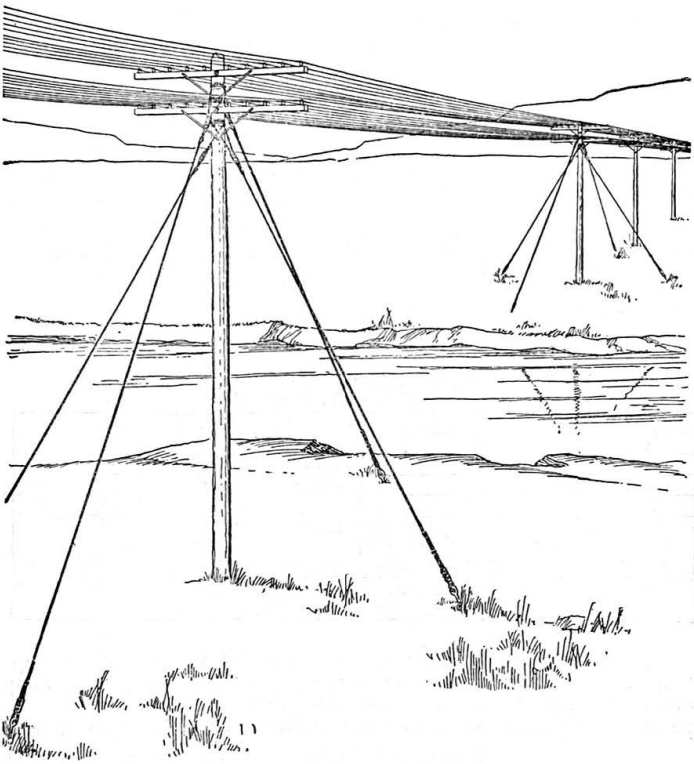
8.01 Where local regulations require that poles at street railway and electric suburban railway crossings be guyed, place such guying as may be required.

9. GUYING LONG SPANS, OPEN WIRE

9.01 Where a single span, 50 per cent. or more in excess of the average span, but not exceeding the minimum length for long span construction methods is inserted in a line, the span should be guyed in accordance with the following:

Number of Crossarms	Head Guy Away From Long Span			Head Guy Toward Crossing Span		Side Guy in Each Direction	
	Number of Guys Required	Size of Strand (Pounds)	Located Under Crossarms	*Number of Guys Required	Size of Strand (Pounds)	**Number of Guys Required	Size of Strand (Pounds)
1 or 2	1	6,000	1st	1	6,000	1	6,000
3 or 4	2	6,000	1st and 3rd	1	6,000	1	6,000
5 or 6	3	6,000	1st, 3rd and 5th	1	6,000	1	6,000
7	2	10,000	1st and 4th	1	10,000	1	10,000
8	3	10,000	1st, 4th and 7th	1	10,000	1	10,000

* Place Guy Under 1st Crossarm
**Place Guy Under 2nd Crossarm



Note: If it is impracticable to place the head guys toward the crossing, place a piece of strand of the same size as would be required for these guys between the crossing poles.