Outside Plant
Pole Inspection

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Pole Inspection and Precautions

This section covers the inspection of poles in service. When inspecting poles, any hazardous conditions resulting from faulty or nonstandard construction should be reported.

Tools

The following tools should be available when inspecting poles:

- Hammer for sounding the poles to detect internal decay and for driving increment borer hole plugs
- Shovel for excavating around the groundline
- Increment borer for determining the internal condition of the poles
- B pole prod for examining pole surface below groundline, determining the internal condition of the poles
- B pole prod for examining pole surface below groundline, determining extent of the top rot, etc.
- Climbers, body belt, and safety strap for use when determining extent of top rot, etc.
- Pole tape for measuring circumferences
- Six-inch steel scale for measuring thickness of shell, and width and depth of decay pockets
- Digging bar for breaking hard or frozen soil
- Increment borer extension for poles set in pavement
- B ratchet brace for turning increment borer extension
- Heartwood black locusts plugs for plugging increment borer holes
- Appropriate safety equipment.

Increment Borer

The increment borer, shown in Figure 12-1, is a tool used for determining the condition of the interior of poles. It consists of a handle, a bit, and an extractor. The bit and the extractor nest in the handle when not use. The bit is hollow and cuts out a cylindrical core of wood. The core, which is drawn out with the extractor, will show the depth of the sound wood and the extent of any decay.

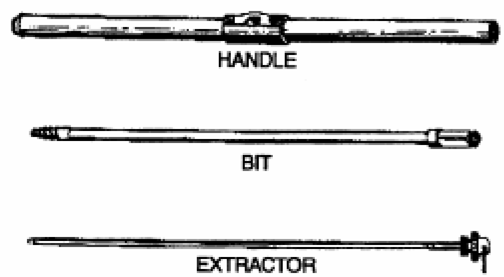

Figure 12-1. Increment Borer

The increment borer is used as follows:

- Prevent damage to the cutting edge of the borer by removing dirt and grit from the surface of the pole at the point selected for boring. Remove the bit and the extractor from the hollow handle.
- Place the square shank of the borer bit in the square hole of the handle and lock it in place.
- To start the borer, press the cutting edge of the bit firmly against the pole surface at the same time turning the handle. Do not jab it into the pole. When the treads have caught the wood, turn the bit in without further pressure. If the pole surface is hard, the borer will start easier in a gaff mark. Never start the borer in a crack or split as the core will wedge in the bit and will be difficult to remove.
- When the bit has reached the center of the pole or desired depth, insert the extractor along the top of the core with the concave side down, taking care not to distort the core.
- When the extractor has been fully inserted back the bit up one-half turn to break off the core. This also rotates the extractor so that it is positioned along the bottom of the core.
- Pull the extractor and core out slowly.

- Do not remove the core from the extractor until the examination of the core is completed. The examination and measurements can be made with greater facility if the core is left in the extractor.

- Unscrew the bit and if pole is not to be condemned, plug the hole with a wooden plug.

- It is desirable, especially in the thinner sapwood poles where decay may be present in untreated heartwood, to sterilize the increment borer holes before plugging them. This will prevent infection, which may be carried from decaying pole to sound poles by the borer. The sterilization may be done with B wood preservative applied with a pressure oilcan.

- The prod, if properly used, should not penetrate sound wood. Therefore, it need not be sterilized after use on decaying pole.

- Make the boring horizontally, i.e., at right angles to the pole surface. If poles set in pavement that is not to be broken, make a boring at the groundline slanted downward at a 45-degree angle.

The use of an increment borer extension, shown in Figure 12-2, will facilitate making borings below groundline and in poles set in pavement. The lower end of the extension is designed to accommodate the bit and the upper end to fit a standard ratchet brace. Some crafts personnel prefer the combination for all boring as it is easier to start the borer and turn it in with the brace than with the borer handle.

This section covers methods of testing poles to determine whether or not they are capable of withstanding the loads to which they will be subjected during climbing and while working aloft.

Pole failures may occur as a result of various causes, although poles that have been given an approved preservative treatment will usually retain their strength for many years, a treated pole may occasionally be encountered that will have a relatively short life because of an inadequate preservative treatment or other unusual conditions. Therefore, it is necessary to exercise care in checking the conditions of all poles, including those that appear to be sound. The failure of a pole is usually due to one or more of the following causes:

- Decay of the pole at or below groundline

- Storm damage

- Mechanical damage, such as might result from a vehicle collision

- Termites, carpenter ants or other insects

- Lighting damage or fire damage

- Woodpeckers

- Application of excessive loads or creating unbalance loads which are excessive under the existing conditions. These excessive loads may result from the use of improper or inadequate construction or maintenance methods.

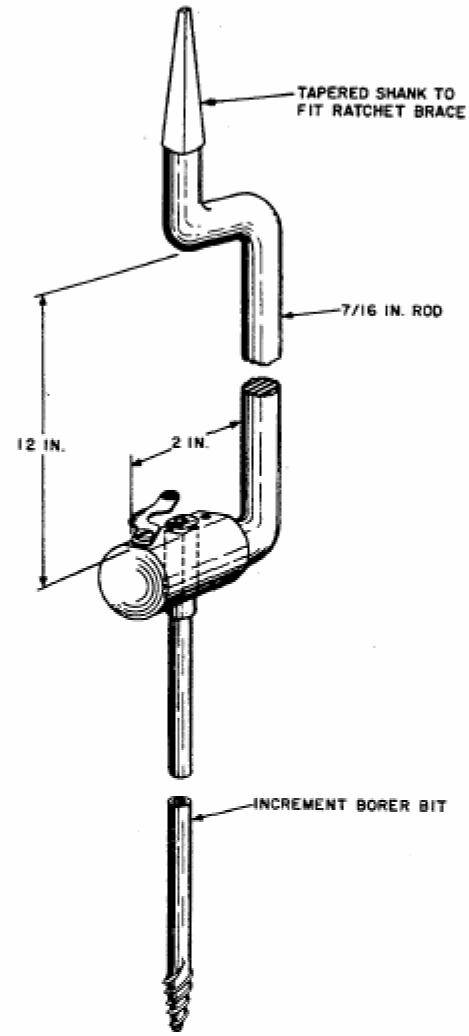

Figure 12-2. Increment Borer Extension

Method of Inspection

Inspection of poles is done in three steps:

1. Visual inspection of the above ground section of poles

2. Sounding and boring to determine the internal condition of the pole

3. Below groundline inspection.

Visual Inspection

All poles must be visually examined before any work operation is begun that involves climbing the pole, placing a ladder against the pole or strand, hanging an aerial platform, riding the strand, etc. While making the visual examination, check the following conditions:

- Any unexplained leaning of a pole. This may be due to failure of the pole at or below groundline.
- Insufficient depth of setting. This may be due to erosion of the earth around the pole as a result of heavy rainfall, flood water, road widening, etc., and would affect the stability of the pole.
- Evidence of collision damage particularly when the pole is at an exposed location along a highway.
- Presence of fungus growth in cracks or protruding from the pole surface or on areas near the groundline where the wood appears water-soaked in contrast to surrounding wood. These systems usually indicate a condition of advanced decay in the interior of the pole.
- Presence of termite or carpenter ant infestation, evidenced by mud channels or debris in the cracks, wood dust at the base of the pole, or movement of ants when the pole is struck with a hammer or other tool.
- Bent, loose, or missing pole steps.
- Wide seasoning cracks that could result in loosening of pole steps and present a climbing hazard.
- Evidence of compression wood indicated by short horizontal cracks along side of the surface of the pole, or by curling of wood away from the pole surface.
- Presence and distribution of large knots, climber gaft splinters, unauthorized signs, aerials, clotheslines, and nearby interfering tree growth.
- Presence of large stones, ground irregularities, debris at base of pole.

- Presence of conduits or vertical runs on pole which might interfere with use of pole steps or climbing.
- Broken wires in adjacent span.
- Excessively tight or excessively slack drop or line wires on one side of pole.
- Contact or insufficient separation between telephone and power wires or other plant on the pole or in the span or spans adjacent to the pole.
- Woodpecker holes.
- Evidence of lightning or fire damage.
- Presence markings or pole tags placed by pole inspector to indicate an unsafe pole or pole to be placed.
- Presence of ice on the pole surface or pole steps that might result in a hazardous climbing.
- Shell rot decay on cedar poles.

Sound and Boring

The sounding test consists of applying blows with a hammer to the pole surface completely around the pole from points close to the groundline to as high as can conveniently be reached. The presence of a hollow heart condition or advanced internal decay can usually be recognized by the characteristic hollow or dull sound resulting from the blows on the wood. Typical examples of internal decay are shown in Figure 12-3. A pole free from decay usually sounds clear and the hammer usually rebounds noticeably when the pole is struck sharply and squarely. Wet surfaces due to high soil moisture, wide cracks, or shakes in the pole near the surface may change the sound of a solid pole. Care must be taken not to mistake the altered sound due to these causes for the sound associated with internal decay.

When internal decay is found, determine its extent and the thickness of sound shell by additional sounding and boring. Shell thickness is measured on the increment borer core using the 6-inch (150-mm) steel scale. Allowances for internal decay shall be based on the minimum shell thickness.

Poles in which the internal decay extends more than halfway around the pole, but which have a continuous shell sound wood, shall be considered as having hollow heart, regardless of the presence of a core of solid heartwood.

Poles in which internal decay extends less than one half of the circumference shall be considered as having a decay pocket.

Below Groundline

If the above ground section of the pole is free from defects or the defects are not sufficient to require replacement of the pole, examine the below ground section.

Excavate around the base of the pole. The depth of excavation required to reach the location of greatest decay depends on the height of the water table and the type of soil. Where the water table is high, maximum decay is usually at or just below groundline.

Where the water table is low, it may be some distance below groundline. In the hard packed clay soils it will be close to groundline and in well drained sandy or gravely soils it may be some distance below groundline. The depth of excavation must be based on local conditions and experience. A general rule is that 8 to 10 inches (200 to 250 mm) is sufficient depth, but in some localities maximum decay occurs 2 feet (600 mm) or more below groundline.

Examine the exposed pole below the ground section with the pole prod for the presence of external decay. When using the pole prod, place the point against the pole surface and push. Do not jab it into the pole and turn so as to remove a slab of treated wood. This is very important when inspecting poles of the shallow sapwood species. Removal of the thin treated sapwood will exposed untreated heartwood to attack by decay organism.

External decay may be around the circumference of the pole, progressing from the surface toward the center of the pole. It may be along cracks, giving the pole a fluted appearance, or it may occur as exposed pockets. Typical examples of external decay are shown in Figure 12-4.

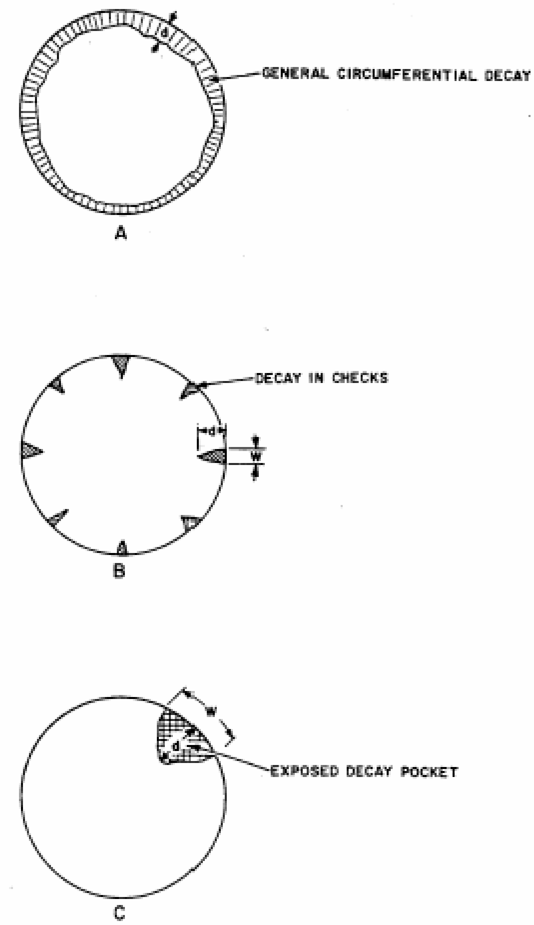

Figure 12-4. Types of External Decay

Sound the exposed below groundline section, supplemented by increment borings, for the presence of hollow heart or enclosed decay pockets. Internal decay below groundline is most common in the thin sapwood types. Unless it is near the surface, the decay is often difficult to detect by sounding. Bore all poles of the thin sapwood type below groundline.

When the inspection is completed, replace the earth packing it firmly around the butt of the pole. If the earth replaced is insufficient to fill the hole and to make a small mound around the pole to compensate for settling, obtain additional earth and use it for this purpose. Stones removed during the excavation for inspection should be replaced against the pole surface when backfilling.

Deductions for Defects

Measurements of poles having hollow hearts may be corrected by deducting the amounts listed in Table 12- 1. For example, a hollow pole having an outer circumference (after any external rot has been removed) of 30 inches (750 mm), and a minimum thickness of shell of 2-1/2 inches (63.5 mm), is equivalent in strength to a solid pole measuring 1 inch (25 mm) less. The pole can then be compared with the dimensions listed in the tables of minimum circumferences at the critical section as it were a solid pole measuring 29 inches (737 mm) at the critical section.

For poles having enclosed pockets on one side or near the groundline, the measurements shall be corrected by deducting the amounts listed in Table 12-2. In this table, depth refers to the maximum depth of radial dimension of the pocket. It lists, for example, that a pole having a 30 inch (750 mm) measured circumference, a minimum shell thickness of 2 inches (50 mm), and a pocket 5 inches (125 mm) deep is equivalent in strength to a solid pole circumference of 1 inch less, 29 inches (737 mm).

Measurements of poles having exposed pockets of varying shapes and dimensions, near the groundline, shall be corrected by deducting amounts listed in Table 12-3, where width refers to the horizontal width at the outside of the pole, and the depth is the average distance obtained by measuring at right angles from a straightedge (such as the prod carried for other purposes) placed across the pocket. This table list, e.g., that a pole having a measured circumference of 30 inches (750 mm) and a exposed pocket 4 inches (100 mm) wide and 3 inches (75 mm) deep will be equivalent in strength to a solid pole circumference of 5 inches (125 mm) less than 30 (750 mm), or 25 inches (635 mm).

Measurements of poles having external decay around the circumference shall be corrected by:

1. Measuring the average depth of decay and deducting six times the depth from the circumference of the pole measured just above the decay.

2. Scraping away the decay and measuring the residual circumference. This is not recommended unless the pole is to be given a supplementary groundline treatment.

Poles that are infested with ants or termites can be expected to deteriorate more rapidly than poles not infested, and extra allowance, based on local experience, shall be made for the more rapid rate of deterioration.

Woodpecker damage may consist of holes that go straight into the pole that are made in search of food, or pole may be hollowed out for nesting purposes. Unless the pole has been hollowed out for nesting, consider the hole as an exposed decay pocket and make appropriate circumference deductions. If the pole has been hollowed out for nesting consider the entrance hole as an exposed decay pocket and hollow out portion as hollow heart and make appropriate circumference deductions. No deductions are made for woodpecker damage above the top attachment on the pole.

Woodpecker damage is not necessarily indicative of other deterioration in a pole. Woodpeckers have been known to attack freshly set, new poles before transfer of attachments had been made. In some cases, however, woodpecker damage may be associated with decay or insect attack (usually carpenter ants). The presence of decay or insect damage may be determined by sounding and/or boring above and below the woodpecker holes.

Storm side guyed poles, guyed comer poles, and poles of H-fixtures may be permitted to deteriorate 10 percent under the replacement circumferences listed in the tables of minimum circumferences at critical section due to the greater stability of these poles.

Table 12-1. Poles With Hollow Hearts

Measured Circumference Of Sound Wood		Minimum Thickness of Shell in Inches													
Inch	Millimeter	in. 2.0	mm 50	in. 2.5	mm 63	in. 3.0	mm 75	in. 3.5	mm 89	in. 4.0	mm 100	in. 4.5	mm 114	in. 5.0	mm 125
20	500	1	25	-	-	-	-	-	-	-	-	-	-	-	-
21	533	1	25	-	-	-	-	-	-	-	-	-	-	-	-
22	558	1	25	1	25	-	-	-	-	-	-	-	-	-	-
23	584	1	25	1	25	-	-	-	-	-	-	-	-	-	-
24	600	1	25	1	25	-	-	-	-	-	-	-	-	-	-
25	635	1	25	1	25	-	-	-	-	-	-	-	-	-	-
26	650	1	25	1	25	-	-	-	-	-	-	-	-	-	-
27	686	1	25	1	25	1	25	-	-	-	-	-	-	-	-
28	711	1	25	1	25	1	25	-	-	-	-	-	-	-	-
29	737	1	25	1	25	1	25	-	-	-	-	-	-	-	-
30	750	2	50	1	25	1	25	1	25	-	-	-	-	-	-
31	787	2	S0	1	25	1	25	1	25	-	-	-	-	-	-
32	812	2	S0	1	25	1	25	1	25	-	-	-	-	-	-
33	838	2	S0	1	25	1	25	1	25	-	-	-	-	-	-
34	860	2	S0	1	25	1	25	1	25	1	25	-	-	-	-
35	889	3	75	2	50	1	25	1	25	1	25	-	-	-	-
36	900	3	75	2	50	1	25	1	25	1	25	-	-	-	-
37	940	3	75	2	50	1	25	1	25	1	25	-	-	-	-
38	965	3	75	2	50	1	25	1	25	1	25	1	25	-	-
39	990	3	75	2	50	1	25	1	25	1	25	1	25	-	-
40	1016	4	100	2	50	2	50	1	25	1	25	1	25	-	-
41	1030	4	100	3	75	2	50	1	25	1	25	1	25	-	-
42	1070	4	100	3	75	2	50	1	25	1	25	1	25	1	25
43	1092	4	100	3	75	2	50	1	25	1	25	1	25	1	25
44	1118	5	125	3	75	2	50	1	25	1	25	1	25	1	25
45	1143	5	125	3	75	2	50	2	50	1	25	1	25	1	25
46	1100	5	125	4	100	2	50	2	50	1	25	1	25	1	25
47	1194	6	150	4	100	3	75	2	50	1	25	1	25	1	25
48	1200	6	150	4	100	3	75	2	50	1	25	1	25	1	25
49	1245	6	150	4	100	3	75	2	50	1	25	1	25	1	25
50	1270	6	150	4	100	3	75	2	50	2	50	1	25	1	25
51	1295	7	178	5	125	3	75	2	50	2	50	1	25	1	25
52	1320	7	178	5	125	4	100	2	50	2	50	1	25	1	25
53	1346	7	178	5	125	4	100	3	75	2	50	1	25	1	25
54	1371	8	200	6	150	4	100	3	75	2	50	1	25	1	25
55	1397	8	200	6	150	4	100	3	75	2	50	2	50	1	25
56	1422	8	200	6	150	4	100	3	75	2	50	2	50	1	25
57	1448	9	230	6	150	5	125	3	75	2	50	2	50	1	25
58	1473	9	230	6	150	5	125	3	75	2	50	2	50	1	25
59	1499	9	230	7	178	5	125	4	100	3	75	2	50	1	25
60	1524	10	250	7	178	5	125	4	100	3	75	2	50	1	25

Table 12-2. Poles With Enclosed Pockets

Measured Circumference of Sound Wood		Maximum Depth of Pocket							
		In.	mm	in.	mm	in.	mm	in.	mm
Inch	Millimeter	in.	mm	3	75	4	100	5	125
22-30	558-750	1	25	2	50	2	50	3	75
22-30	558-750	2	50	-	-	1	25	1	25
22-30	558-750	3	75	-	-	-	-	-	-
31-38	787-965	1	25	2	50	3	75	3	75
31-38	787-965	2	50	1	25	1	25	2	50
31-38	787-965	3	75	1	25	1	25	1	25
39-50	990-1270	1	25	2	50	3	75	4	100
39-50	990-1270	2	50	1	25	2	50	2	50
39-50	990-1270	3	75	1	25	1	25	1	25

Table 12-3. Poles With Exposed Pockets

Depth of Pocket (Inches)	Width of Pocket (Inches)							
	1	2	3	4	5	6	7	8
1	1	1	2	2	3	3	4	5
2	1	2	3	4	5	6	7	8
3	1	2	4	5	6	8	9	11
4	2	3	4	5	7	9	10	13
5	2	3	4	5	7	9	11	-

Depth of Pocket (Millimeters)	Width of Pocket (Millimeters)							
	25	50	75	100	125	150	178	200
25	25	25	50	50	75	75	100	125
50	25	50	75	100	125	150	178	200
75	25	50	100	125	150	200	230	279
100	50	75	100	125	178	230	250	330
125	50	75	100	150	178	230	279	-

Required Circumferences

Determination of whether a pole meets the minimum circumference requirement is based on the actual circumference of sound wood at the critical section or equivalent circumference of sound wood at the critical section after deductions for defects as described in this section have been made. Required minimum circumferences may be determined by means of the table of minimum circumferences at the critical section.

The critical section is considered as the section a pole mostly likely to fail because of deterioration by decay or insect damage. In most areas maximum decay will occur at the groundline or at least one-foot (300 mm) below groundline. In such cases, the groundline is considered the critical section. In some areas, because of the character of the soil or moisture conditions, maximum decay may occur one foot (300 mm) or more below groundline. In such cases the critical section is considered at the point of maximum decay.

If the maximum deterioration occurs at a point above groundline, the critical section is considered as the groundline and required circumferences are determined as follows:

- If the section of maximum deterioration is below a point one-fourth the distance from groundline to the top of a pole, the required circumference is that determined from the tables of minimum circumferences at the critical section or the pole inspection rule.

- If the section of maximum deterioration is between the quarter point referred to above and the midpoint of a pole, the required circumference is 10 percent less than that determined from the tables of minimum circumferences at the critical section or the pole inspection rule, but not less than 14 inches (356 mm). For example, if the required circumference at the critical section is 30 inches (750 mm), the circumference required at the higher point is 30 inches (750 mm) minus 3 inches (75 mm), or 27 inches (686 mm)

- If the section of maximum deterioration is between the midpoint and the top of the pole, the required circumference is 20 percent less than that determined from the tables of minimum circumferences at the critical section, but not less than 14 inches (356 mm). For example, if the required circumference at the critical section is 30 inches (750 mm), the circumference required at the higher point is 30 inches (750 mm) minus 6 inches (150 mm), or 24 inches (600 mm).

Recommendations

When the circumference at the critical section is less than the minimum as determined from the tables of minimum circumferences at the critical section or when a pole has been badly weakened by burning, cracking, splintering, or other mechanical damage, replacement shall be recommended. Also, replacement shall be recommended for those poles that, due to deterioration, have a circumference at the critical section above the required minimum, but will further deteriorate so their circumference will be below the minimum by the time of he next inspection.

Poles shall be reported immediately that have deteriorated sufficiently because of decay or insect infestation, or have sufficiently weakened by mechanical damage to be obviously dangerous and could be broken off while climbing or working aloft, or constitute a hazard to the public or employees.

Replacement of defective poles that are not dangerous shall be made as soon as practical on a regular replacement schedule. The proper class and spacing to be recommended for new poles, considering any additional attachments that will be required within an economical period, shall be determined by plant engineering.