Attachment 1
Detailed Procedures

1. Pole Intrusive Inspection Programs

Pole inspection programs meeting the intrusive inspection requirements of G.O. 165 are carried out on a systemwide basis by Pole Asset Management. Generally, these inspection programs detect poles with damage or decay from the groundline to the pole top. The Qualified Company Representatives (QCRs) inspecting the poles report whether poles are OK or are suitable for restoration and/or reinforcement.

2. Testing Wood Poles and Stubs

See Exhibit A, Part 1, for a quick reference.

QCRs doing line inspections do not need to intrusively inspect every pole. The Pole Test and Treat program does this. However, QCRs doing line inspections must perform visual inspections. If they believe that further testing is warranted to evaluate a pole's condition, the procedures in this standard must be followed.

These procedures provide inspection and testing methods to determine the serviceability and structural integrity of wood poles. For additional guidance regarding handling of treated wood, refer to the Compliance/Guidance section for treated wood in the Environmental Affairs web site on the Company Intranet.

These procedures do not replace the requirements stated in the *Code of Safe Practices* (CSP), Rules 414 and 417, or in DCS Standard D-S0411, "Wood Poles - Testing Before Climbing."

All three of the following procedures are necessary to determine the serviceability and structural integrity of wood poles that have been in service more than 10 years. Only the first two procedures are necessary for poles that have been in service less than 10 years unless either procedure indicates that further testing is warranted. Record test measurements using the "Pole Inspection/Test Report" form (Exhibit A, Part 3).

Note the presence of Test and Treat or Company-provided reject tags (e.g., "N," "S," or arrow "↑," refer to Electric Design Standard 022168).

If the tag on the pole indicates that the pole has been inspected and treated within the past 2 years, note this as a comment on the inspection form and check the local maintenance records to determine the prior pole condition and whether it is scheduled for replacement or reinforcement. Poles within 2 years of treatment normally should not be retested.

Exception: Test poles before climbing in accordance with DCS Standard D-S0411.

Otherwise, for previously rejected poles with greater than 2 years between inspection or treatment, remove the plastic plugs and remeasure the average shell thickness using the existing holes (or bore new ones if necessary). Record the new measurements on the pole inspection form, note any comments, and check the local maintenance records to determine the prior pole condition and whether it is scheduled for replacement or reinforcement.

Note: Do not drill through existing hardwood plugs. Instead, bore a new hole(s) in accordance with the procedures outlined below. Pole Asset Management currently maintains a limited supply of 7/8-inch plastic plugs as replacement for existing 7/8-inch hardwood plugs. Also, 9/16-inch plastic plugs and preservative rods are available through coded stock as described below.

A. Visual Inspection

The visual inspection shall include the determination of pole height, class, wood type, original treatment type, previous remedial treatments (if any), prior restoration history (if any), circumference at groundline, joint use attachments, and condition of guy supports. The visual inspection shall identify above-groundline compression wood, bird (avian) or insect holes, shell rot, fire or mechanical damage, breaks or cracks, loose or broken hardware, damage to crossarms, damaged conductors, and other conditions which could render the structure unserviceable.

The QCR should first verify that the pole was set to the proper depth using the height of the brand or other like marker (e.g., date nail), and minimum pole setting depths listed in Electric Design Standard 015203, “Strength Requirements for Wood Poles,” as a guide.

1. Pole Top or Woodpecker

The QCR should note the approximate location, number, and size of woodpecker holes on the “Pole Inspection/Test Report” (Exhibit A, Part 3).

Determine whether identified aboveground or pole-top damage is suitable for restoration. Poles are suitable for restoration and can remain in service if they meet the criteria listed below:

a. There is 1 vertical inch of solid wood directly below any throughbolt to support existing or proposed attachments.

b. Nesting cavities or other open pockets have an outside hole diameter that is less than 4 inches wide.

c. Internal cavities are estimated to be less than 12 inches high and 7 inches in diameter.

d. The average shell thickness of the cavity is greater than 1 inch within the top 10 feet of the pole, and greater than 1½ inches between 10 feet and 20 feet from the top. See Exhibit B, Part 1, for shell thickness between 20 feet of the pole top and the groundline.

e. There is more than 12 inches of sound wood vertically between nesting cavities.

f. There are three or fewer starter holes less than 3 inches wide, 3 inches high, and 5 inches deep within any 1-foot vertical section of the pole. The maximum sum of the diameters of the holes must be less than 9 inches wide in a 1-foot vertical section.

g. The pole-top crown damage or split tops extend downward less than 6 inches from the pole top.

2. **Other Surface Problems**

   For mechanical, shell, or burn damaged poles, remove as much damaged wood at or near the groundline as feasible and measure the resulting effective circumference at the point with the most damage. The original circumference is measured from the point below the mechanical damage best approximating the original nondamaged circumference of the pole. Record the measurements on the “Pole Inspection/Test Report” and compare them to Exhibit E, noting in the “Comments” field the height (above groundline) of the mechanical damage.

B. Sound Inspection

This inspection helps identify portions of the pole with obvious internal deficiencies. A hollow sound during a hammer test only indicates areas on the pole where additional bore testing may be necessary, as described below, to fully assess the condition of the pole. The sound inspection shall test all sides of the pole with a 20-ounce minimum metal hammer from the groundline to a height of 7 feet, or as high as the inspector can reach, whichever is the greater, to identify possible internal voids or hollows. Hammer marks shall be visible on the pole.

If, upon performing the required visual inspection and hammer test, the QCR believes a pole to be suspect, the pole shall be further tested and assessed in accordance with this standard. After the pole inspection has been completed, the QCR shall complete the “Pole Inspection/Test Report” and forward it to estimating for further evaluation and action.

C. Bore Test

Locate the largest check at the groundline and excavate to a depth of 20 inches an area wide enough to accommodate the drill.

Inspect for surface (shell) decay. For all Cellon-treated poles, or if any groundline surface decay is found, excavate 360° around the pole to a depth of 20 inches and “chip” or scrape the pole to remove decayed wood from the pole shell down to good wood and measure the resulting groundline circumference. Record the measurement on the “Pole Inspection/Test Report.” Remove any decayed wood chips from the excavation so the chips will not contribute to further deterioration of the pole.

Bore a minimum of three 9/16-inch holes at a 45° angle to the axis of the pole, with each bore extending beyond the center of the pole. Take care not to break through to the other side. Always bore with a long-shank ship auger (Code 200958) to allow observation of the wood shavings.

Note: If the pole has been previously tested and the previous bores are in the proper locations, bore a new hole approximately 2 inches below and to the right of existing bore-hole wooden plugs or reinspect the previous bore by removing the plastic plug(s).

Start the first bore adjacent to the largest seasoning check, 12 inches below the groundline. Each successive bore shall be 120° to the right and 12 inches above the previous bore. Examine the shavings to determine if wood decay is present. If decayed wood or void is present, bore a sufficient number of additional holes to determine the extent of decay and the average shell thickness.

If a pole is set in asphalt or concrete, or otherwise cannot be excavated, start the first bore adjacent to the largest seasoning check at the groundline. If internal voids are present in a pole set in asphalt or concrete, the pole shall be rejected as unsuitable for treatment and evaluated for the feasibility of restoration or reinforcement.

Bore test exception: Throughbored Douglas fir pentachlorophenol or copper naphthenate full-length treated poles that are less than 20 years old **should not** be bore tested within 18 inches of the groundline, unless there is other evidence indicating the presence of groundline damage or decay. Instead, bore the first inspection hole 12 inches above the top row of throughbored holes.

Note: Beginning in 1986, poles greater than 55 feet (and starting in 1990 all Douglas fir full-length oil-treated poles 40 feet and longer) have been throughbored within 15 inches of the intended groundline using a series of 7/16-inch holes drilled through the groundline zone to improve penetration of the preservative and extend the life of the pole (refer to Electric Design Standard 058032).

To determine the thickness of solid (but not necessarily sound) wood, insert a shell-thickness gauge (see Figures 1 and 2, on Pages 10 and 11) into the holes made by boring. When pushing a tight fitting, shell-thickness gauge into a pole, the employee can feel the tip of the hook pass from one growth ring to another in solid wood, but not in decayed wood. Inscribed marks on the sides of the shell-thickness gauge indicate the shell thickness at different drilling angles, usually 45°.

Pull the shell-thickness gauge back while turning it, until the inside wall is identified. When the shell-thickness gauge is pulled back with pressure against the side of the hole, the hook at the end should catch on the edge of sound wood inside the decay pocket.

Using the scale on the gauge, read and record the measurement.

D. Assessing Test Results

If decay or a void is detected, evaluate the pole further for reinforcement or restoration. All damaged or deteriorated poles shall be evaluated to determine the most economic solution to ensure that the pole complies with G.O. 95 requirements. All poles recommended for replacement, reinforcement, or restoration shall be plainly marked with the appropriate pole tag described in Electric Design Standard 022168.

Refer to Exhibit B, Electric Design Standard 063418, “Wood Pole Reinforcement Using Steel Trusses,” and Electric Design Standard 066209, “Repair of Damaged Pole Tops,” for evaluating measurements, restoration, and reinforcement criteria.

While the QCR is in the field, take the following steps to gather sufficient information to help evaluate the pole condition:

1. Check whether the pole is suitable for a steel truss or fiberwrap reinforcement. If the average shell thickness at the groundline is less than 2 inches, bore additional horizontal holes at 15 inches and 42 inches above the groundline. If the average shell thickness is less than 2 inches at 15 inches and/or less than 4 inches at 42 inches, evaluate the pole for a longer truss as described in Paragraph 2 below.
2. Bore additional holes at 26 inches and 54 inches above the groundline. If the average shell thickness is less than 2 inches at 26 inches and/or less than 4 inches at 54 inches above the groundline, or there are any non-restorable voids or woodpecker holes between 66 inches and 20 feet above the groundline, the pole is not suitable for steel stubbing.
3. If the pole is not suitable for stubbing, evaluate it for fiberwrap by boring additional holes at 12-inch intervals vertically and checking the average shell thickness to determine the height of the void up to a maximum of 84 inches. If there is any void above 84 inches, the pole is not normally economically suited for fiberwrap. All measurements must be recorded on the "Pole Inspection/Test Report" (Exhibit A, Part 3).
4. If the pole strength is found to meet or exceed G.O. 95 strength requirements, determined from the evaluation in Exhibit B, or to be suitable for reinforcement so that it will meet or exceed G.O. 95 strength requirements and all external decay or damage has been removed at the groundline, install a copper napthanate "preservative wrap" (Cobra Wrap, Code 560490) around the exposed area before backfilling the excavation.
5. Plug the inspection holes. Insert a boron rod (Impel rod, Code 140037, 100 rods per bucket) into each inspection hole and seal the hole with a reusable plastic plug (Replug, Code 140038, 200 plugs per bucket). Complete a "Pole Inspection/Test Report" (Exhibit A, Part 3) and cross-reference it to an Electric Preventive Corrective Maintenance (EPCM) Tag to indicate if corrective action is required.

   Note: Poles to be reinforced must be properly treated with approved preservatives by a licensed applicator. Poles selected to remain in service will normally receive preservative treatment at the time of reinforcement or during the systemwide Test and Treat program.

   Note: Refer to Exhibit B, Part 1, for evaluating measurements and acceptance criteria. If this evaluation indicates that the pole is below 67% of its original strength and the pole cannot be reinforced, send the completed "Pole Inspection/Test Report," (Exhibit A, Part 3), to estimating for further evaluation , safety factor calculation, prioritization, and action.

3. Testing Cellon Treated Poles

Cellon or Dow gas-treated poles designated by the brand "DFG" have exhibited higher rates of external decay occurring below the groundline. Therefore, the pole testing procedures shall be extended to include the following:

A. Excavate 360° around the pole to a depth of 20 inches. Inspect for surface (shell) decay. If decay is found, "chip" or scrape the pole to remove the decayed wood from the pole shell down to good wood and measure the resulting groundline circumference. Record this measurement. Remove decayed wood chips from the excavation so the chips will not contribute to further deterioration of the pole.

B. Bore, test, and plug the holes as described in the previous section. Belowground decay in gas-treated poles in concrete or asphalt can be difficult to detect. Therefore, it is important that the QCR bores inspection holes deeply and across as much of the pole cross-section as possible and looks carefully for any signs of external decay, mildew, moisture, stains, etc., noting any findings on the inspection report. If the pole strength is found to meet or exceed G.O. 95 strength requirements (determined from the Exhibit B evaluation) or is suitable for reinforcement so that it will meet or exceed G.O. 95 strength requirements and all decay has been removed at the groundline, install a copper napthanate "preservative wrap" (Cobra Wrap, Code 560490) around the exposed area prior to backfilling.

4. Assessment

After a pole inspection has been completed by a QCR, the pole inspection report will indicate the pole condition as "OK," "Reinforce," "Restore," or "Replace" depending on the extent of decay, the strength at the groundline, and the overall serviceability from the groundline to the pole top. A climbing or aerial inspection may also be warranted to better assess pole-top damage.

Any "unsuitable" pole, which has not been identified as requiring immediate attention on the inspection report, may still be a candidate for restoration and/or reinforcement and should be evaluated as such. Whatever corrective action is selected should be the most economical, approved procedure(s) available to maintain the structural integrity and serviceability of the pole(s).

All of the restoration and/or reinforcement techniques discussed in this standard **require** the application of appropriate external and internal preservative treatments to help control existing decay and/or insect infestation, and to help prevent new decay and/or insect infestation from becoming established in the sound wood. Generally, the application of groundline preservative treatments will be applied by the Test and Treat or pole reinforcement contractor. In the case of aboveground deterioration, Impell Rods or copper napthenate (Code 490718) should be applied by Company employees to control or prevent aboveground decay.

Restoring or reinforcing poles is usually more economical than replacing poles. Therefore, always consider restoring or reinforcing poles before replacing them.

The economic feasibility of pole restoration or reinforcement is based upon the cost to treat and restore the existing pole versus the cost of installing a new pole, transferring conductors and/or equipment, and the disposal cost for the old pole (see Exhibit C).

When a pole is found to have decay; mechanical, bird, insect, or fire damage; or shell or heart decay resulting in a pole condition that is below G.O. 95 standards, it must be restored, reinforced, or replaced.

For poles whose circumference was reduced due to surface decay, shell rot, mechanical, fire, or insect damage, the measured effective circumference compared to the original circumference shall be greater than the minimum circumference allowed (shown in Exhibit E) for the pole to remain in service without reinforcement. In some cases, the pole class must be reduced and loading re-evaluated accordingly. Refer to Note 13 on Page 3 of Electric Design Standard 015203, "Strength Requirements for Wood Poles," for calculating the resulting capacity. The pole should remain in service if it has adequate capacity and if no other defects are found that cannot be corrected.

5. Pole Restoration

Restoration is possible if the wood pole has structural integrity with sufficient shell thickness and sound wood adjacent the deterioration, or its structural integrity can be reinforced to serviceability.

Restoration techniques include, but are not limited to, the application of pole-top extensions, pole splints, woodpecker repairs, steel pole guards, and fiberwraps.

6. Pole Reinforcement

When a pole is found to be below the required strength near, at, or below the groundline level, and it cannot be restored to serviceable condition, it must be reinforced or replaced to meet the conditions established in G.O. 95.

Reinforcement is possible if the wood pole has a good shell and sound wood above the groundline to the pole top.

Reinforcing poles is usually more economical than replacing poles. Therefore, always consider reinforcing poles before replacing them.

The economic feasibility of pole reinforcement is based upon the cost to treat and reinforce the existing pole versus the cost of installing a new pole, transferring conductors and/or equipment, and the disposal cost for the old pole (see Exhibit C).

7. Pole Reinforcement Methods

See Exhibit A, Part 2, for a decision matrix. Exhibit F provides a quick method of determining the economics of reinforcement versus replacement.

A. Steel Truss

Refer to Electric Design Standard 063418, "Wood Pole Reinforcement Using Steel Trusses."

Use steel trusses throughout the Company system including urban areas. They are constructed of galvanized steel and, depending upon strength requirements, are produced in various lengths and thicknesses. Drive steel trusses into the ground, snug against the pole, with special rigging equipment and a hydraulic or air hammer. High-strength steel straps band the truss to the pole.

Steel trusses are usually the least expensive of all reinforcing methods. They should be used on poles where there is a 2-inch average sound shell present at either 15 inches or 26 inches above the groundline and a 4-inch average sound shell at 3½ feet or 4½ feet respectively above the groundline on the pole. Normally a single steel truss will adequately support the pole to meet the minimum loading requirements of G.O. 95. Generally, if there is less than 1 inch of shell in any one enclosed packet more than 6 inches wide and 2 inches high in the banding area, it is unsuitable for stubbing and should be considered for a fiberwrap.

B. Fiberwrap

Fiberwraps may be used throughout the system and may be especially desirable in urban areas. They are constructed using a system of custom-fit, fiberglass repair material and are applied in the field. Several layers of high-strength fiberglass are wrapped onto the pole, and each layer is saturated with a polyester resin. The resin is designed for above or belowground installation, as well as for corrosive environments. The system is designed to withstand stresses generated by changes in moisture content in the pole, and so that ultraviolet light will not affect the strength of the fiberwrap restoration. The surface finish can be designed to blend with the pole.

Fiberwrap restores the structural integrity of the pole to its original strength and, if economic, can be extended to any height necessary to repair the pole where steel truss restoration does not apply. Some examples are situations where external and/or interior decay extends high up the pole and a truss is impractical, where the terrain limits access to the pole by vehicle or equipment, and where clearance (e.g., multiple risers) on the pole restricts the use of trusses.

The primary criteria for fiberwrap is that the pole has 3 inches of sound shell 36 inches below the ground. Normally this measurement will be verified by the fiberwrap contractor. However, to avoid unnecessarily sending a contractor to an unreinforceable pole, the shell thickness below the ground and the condition of the pole above the ground shall be confirmed to the extent feasible.

Fiberwrap also offers other benefits, such as the ability to straighten poles, repair property line poles, and repair poles that are not reinforceable with steel stubs when the pole does not have sufficient sound wood to support the stub bands at 15 inches or 26 inches above the groundline.

C. Modular Pole Modules

Refer to Electric Design Standard 060579, “Construction Requirements Using the Modular Pole Butt Replacement System.”

Modular pole modules are tapered, prestressed, concrete replacement pole butts and are presently available in 9-foot, 14-foot, and 18-foot lengths. To secure the existing wood pole top to these modules, a steel connecting sleeve and a high-strength, fast-setting grout is provided. Modular pole modules can be used for emergency repair of poles (i.e., car pole accidents where poles have been broken at or a few feet above the groundline). The modular pole may also be used to replace a badly deteriorated pole butt, to increase the pole height to accommodate additional circuits or apparatus, and for pole relocation and road widening projects.

8. Reusing Wood Poles

A pole should be salvaged and reused if it has 10 years of remaining life. Poles up to 20 years of age should be considered for reuse if they are tested and proved to be sound in accordance with the inspection procedures outlined in this standard and the *Code of Safe Practices*. This criteria applies to poles that are owned and maintained by the Company, and may be applied to new or used poles provided by third parties.

Consult the T&D technical support, wood-pole product engineer for assistance concerning the inspection of wood poles being considered for reuse. Electric Design Standard 025055 in the *Electric and Gas Service Requirements* provides additional information.

A. Hammer, bore test, and assess the pole according to this standard. If there are less than 3½ inches of average shell thickness 6 feet from the butt, do not reuse or accept the pole.

B. Scrape and remove any external decay or damage, and measure the resulting circumference 6 feet from the butt and at the pole top to determine the class of the pole (see American National Standards Institute [ANSI] pole dimension criteria in Exhibit D).

   Note: Cedar poles require larger circumferences than Douglas fir to meet the same strength requirement.

C. Determine the age of the pole either from the brand or the date nail. Ponderosa pine, Cellon or Dow gas-treated fir, and poles older than 20 years should not be reused.

D. Checks in the climbing area of the pole, between expected groundline and to within 5 feet from the top, should not exceed ¾ inch in width and exceed 3 feet in length measured downwards from the point where the check is at its maximum (i.e., the point where it exceeds ¾ inch).

E. Knots should not exceed 2½ inches in diameter for poles less than or equal to 45 feet and 3 inches for poles greater than 50 feet. The sum of knot diameters in any knot cluster should not exceed 9 inches in any 1-foot vertical section of the pole.

F. Poles with significant avian, fire, or other damage, or poles with split tops to the intended crossarm level should not be reused.

G. Plug all inspection holes with a boron rod (Code 140037) and plastic plug (Code 140038). Place a new date nail adjacent to the existing date nail, if any (to denote the pole set as used).

H. Before reusing any wood pole, treat all "cut" surfaces (i.e., poles topped, gains, drilled holes) with copper naphthenate (Code 490718) or a Company-approved wood preservative.

I. A Company-approved "preservative wrap" (Cobra Wrap, Code 560490) shall be installed at the jobsite before setting any used pole.

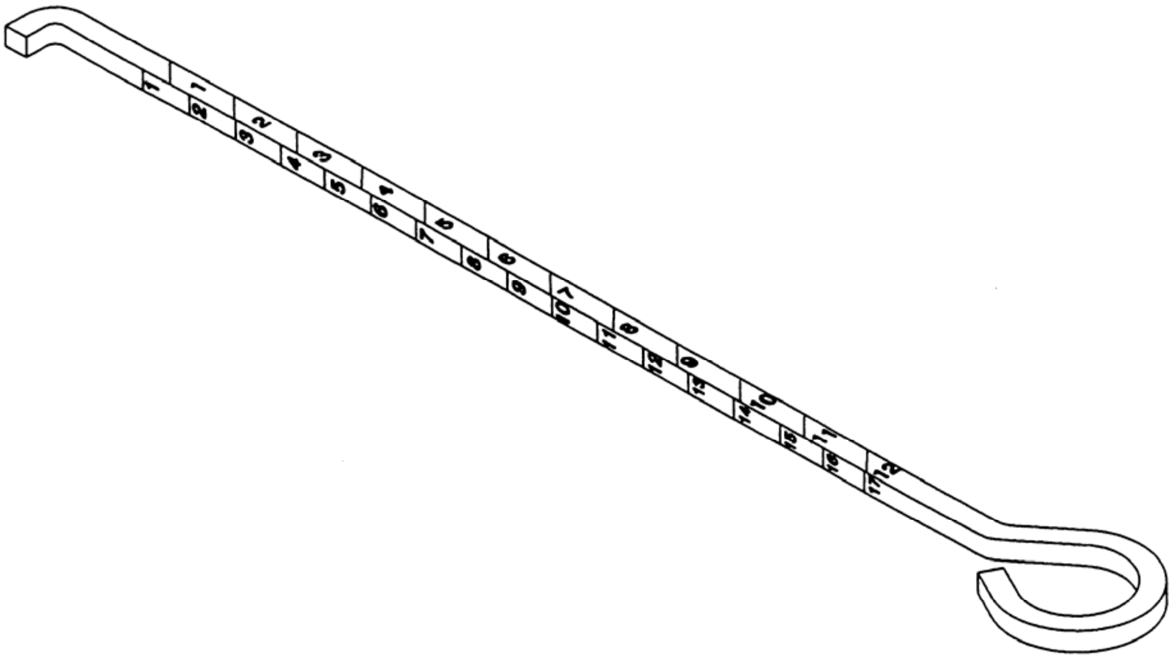


Figure 1
Shell-Thickness Gauge
(Code 204908)

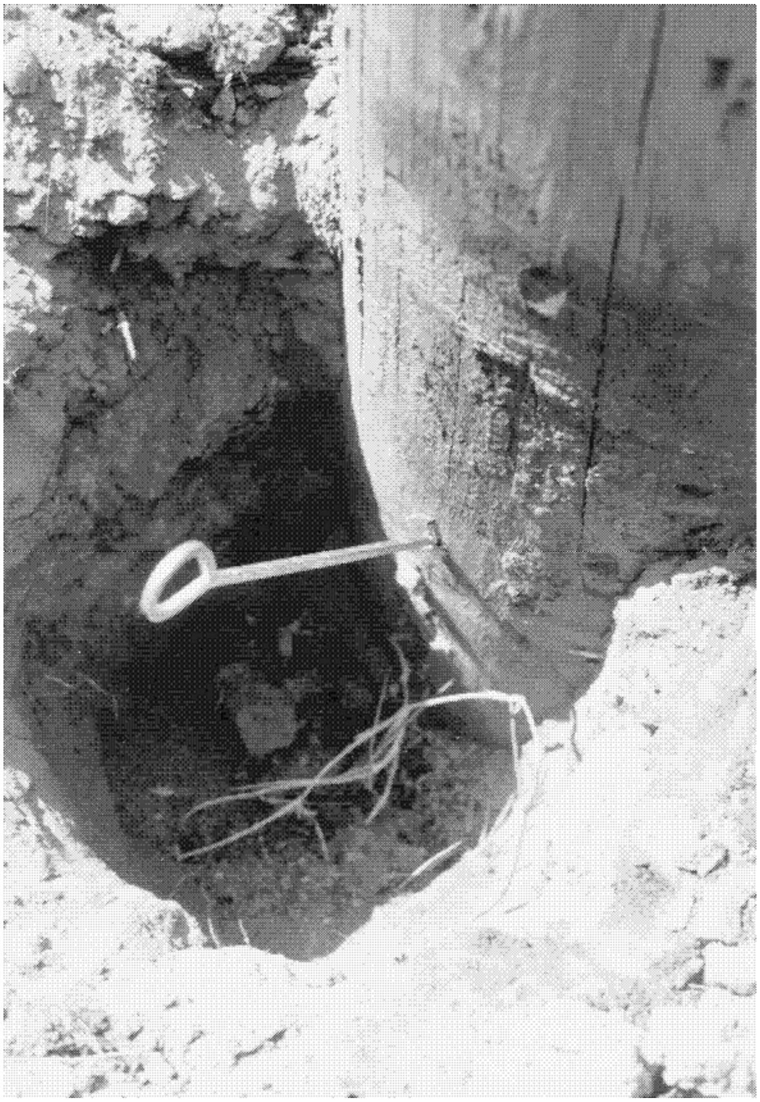


Figure 2
Shell-Thickness Gauge

Exhibit A (Part 1)
Pole Testing Sequence

Visual Inspection

A. Pole height, class, type, restoration tags, etc.
B. Shell rot, compression wood, woodpecker damage, split tops.
C. Loose or broken hardware, crossarms, conductor damage.

Sound Inspection

A. Strike the pole with a hammer from the groundline to a height of at least 7 feet.
B. A hollow sound indicates areas for additional assessment.

Bore Test

- Full or butt-treated pole → **Excavate adjacent to the largest check.**
- Cellon → **Excavate 360° around the pole.**
  A. 20” depth completely around the pole.
  B. Scrape any decay.

20” depth and wide enough to accommodate the drill

Bore three 9/16” test holes.

A. Begin boring adjacent to the largest check, 20” below the groundline.
B. Make successive borings 12” above and 120° to the right of the previous boring.
C. Examine the shavings for decay.

Probe for voids and measure the shell thickness.

Void found?

- Yes → **Bore additional holes to determine if the pole is suitable for reinforcement.**
  A. See Exhibit A, Part 2.
  B. See Electric Design Standard 063418.
- No →

Complete Exhibit A, Part 3

Exhibit A (Part 2)

Pole Replace/Reinforce/Restore Decision Matrix

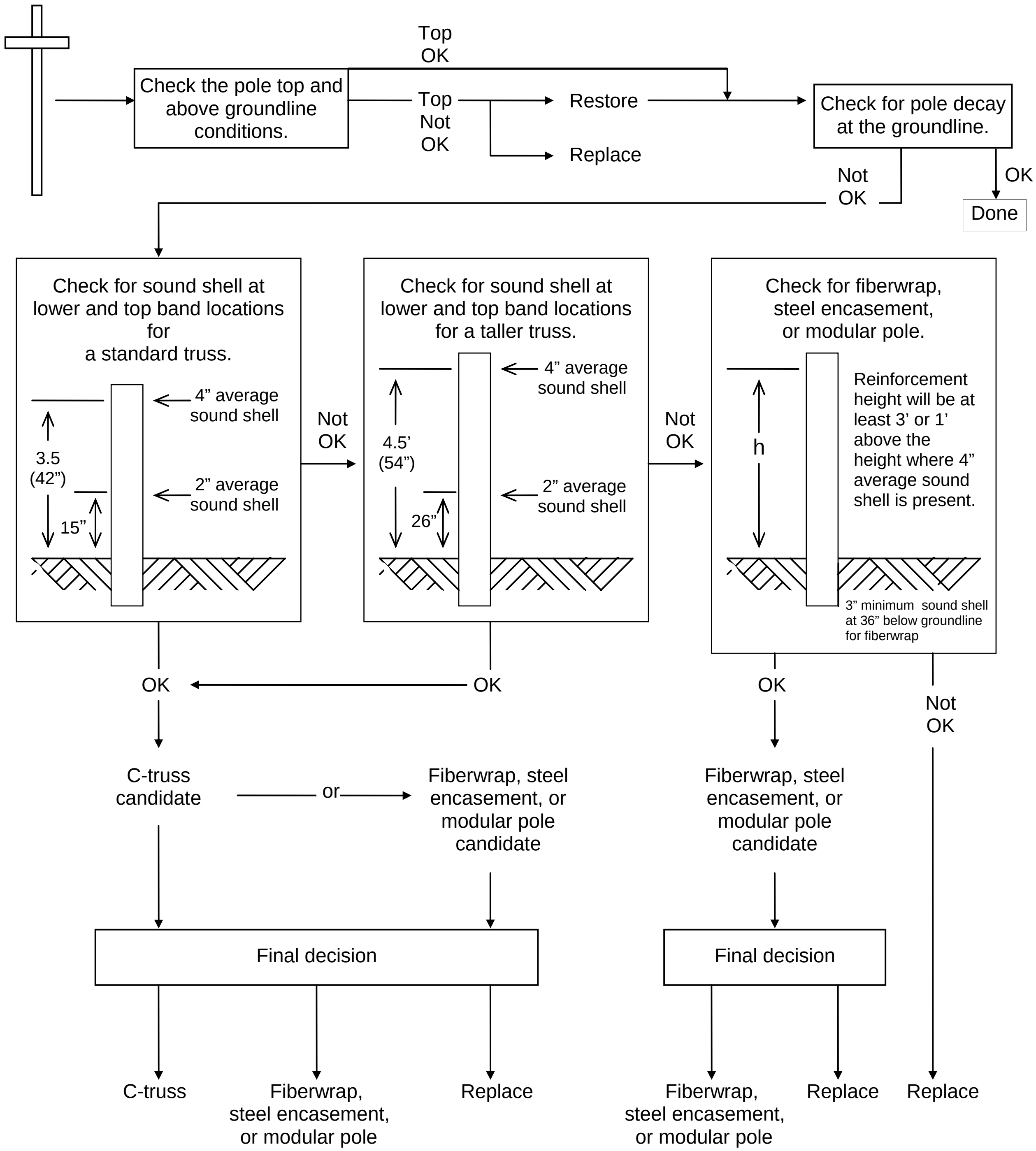


Exhibit A (Part 3)

PG&E

Pole Inspection/Test Report

Notification #

Date Inspected	**Road Map #**
Inspector	**Reference #**
Location	**Circuit #**
X Street	**Area**
City	**Pole Test Rejection #**

Condition of Pole (Groundline to Pole Top)

Visual Inspection	Pole Description		Owner
❑ Vehicular, Mechanical, Insect, Avian, or Fire Damage	❑ Multi-Circuit	Height and Class _______________	❑ PG&E
❑ Split Top	❑ Equipment Pole	Groundline Circumference: Orig.___________Effective_________	❑ Joint Pole
❑ Checks	❑ Bucket Truck Accessible	Year Manufactured __________	
❑ Shell Rot	❑ Angle > 5°	Year Set ___________	
❑ OK			
❑ Woodpecker Holes Size ______ Number ______			

Description of Decay Pocket (At or Near Groundline)

Description	**Dimensions**
Height Where 4" Average Shell Obtained*	
Solid at 5½' (66") Circle Yes or No	Yes No
Average Sound Shell at 4½' (54")*	
Average Sound Shell at 3½ ' (42")	
Average Sound Shell at 26" *	
Average Sound Shell at 15"	
Average Sound Shell at Groundline	
Average Sound Shell at 12" Below Groundline	

* These measurements are not necessary if criteria at 15" and 42" for steel truss are met.

Comments

Species	❑ Douglas Fir	❑ Cedar	❑ Other: ___________	❑ Unknown

Corrective Action Required

❑ Treat Only ❑ Restore ❑ Climbing Inspection Required (Reason for inspection required in comments)

❑ Reinforce ❑ Replace

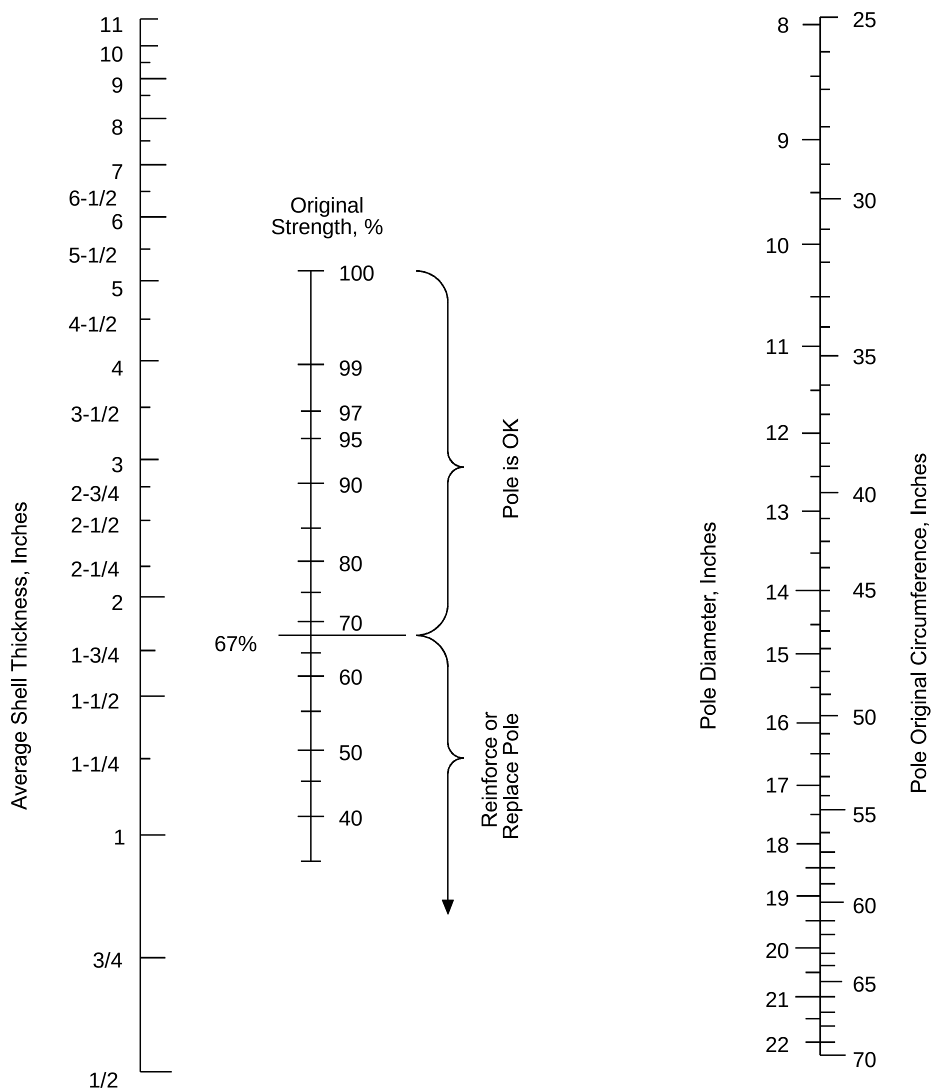
Grade of Construction (Circle one) A B C

Safety Factor Evaluation	Groundline	Factor __________	By __________	Date __________
	Top	Factor __________	By __________	Date __________

Work Completed By **Date**

Exhibit B (Part 1)

Pole Strength Table



Note: For pole circumferences greater than 70" (i.e., generally cedar poles larger than 80 feet, Class H3) apply the formula below to determine the percentage of original strength.

$$\% \text{ original strength} = 1 - [1 - (\text{shell thickness} / \text{pole diameter}) \times 2]^4$$

Exhibit B (Part 2)

Pole Strength Example

Example:

Testing a pole with a 30-inch circumference at the groundline. Internal decay is found in the center of the pole. The shell-thickness gauge measures an existing average shell thickness of 2 inches.

1. Place one end of a ruler at the 30-inch increment of the pole circumference scale.
2. Place the opposite end of the ruler at the 2-inch increment of the shell-thickness scale.
3. The percent of the original pole strength can now be determined. The pole strength is 88% of the new or original pole strength.

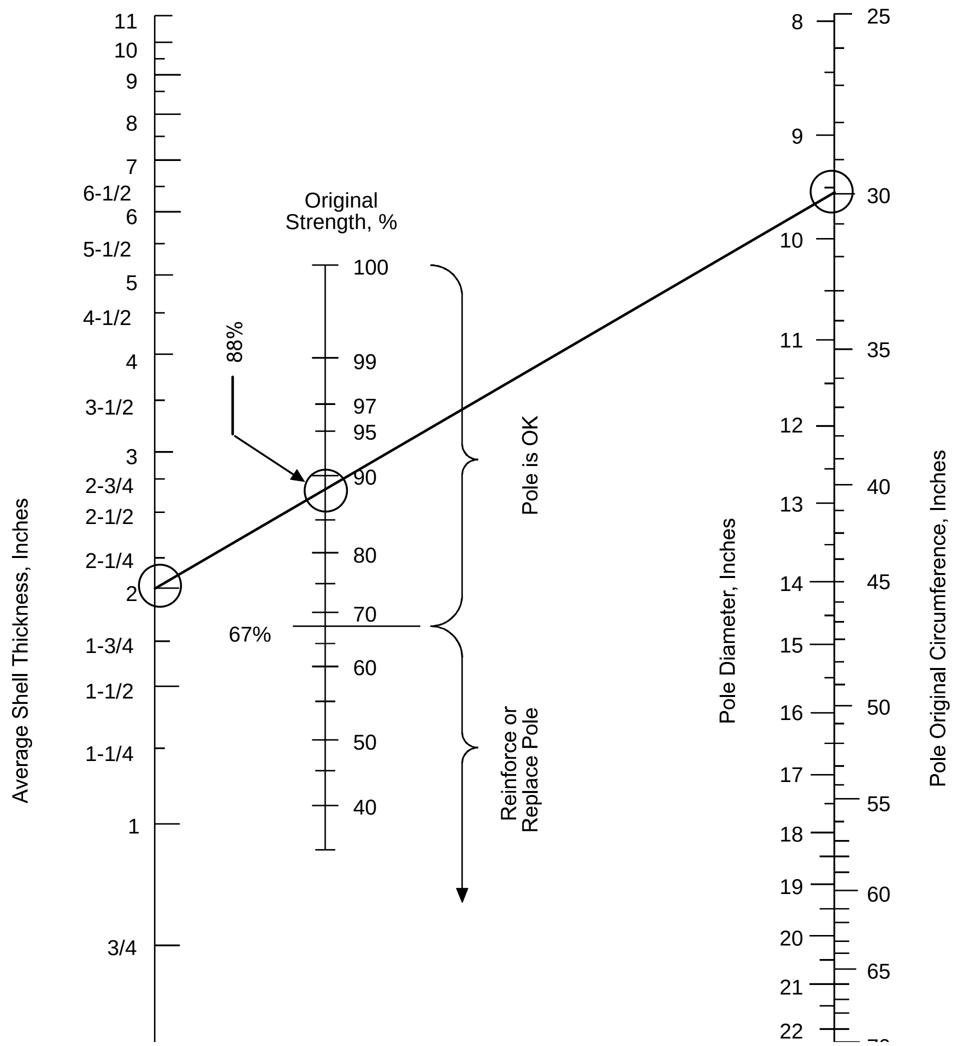


Exhibit C

Typical Reinforcement Considerations

All reinforced poles must be treated by a licensed applicator at the time of reinforcement

Steel Truss

The material cost of a steel truss averages $250, including the truss, bands, fasteners, taxes, and shipping. The total contractor-installed cost, including treatment, will vary from $350 to $800, depending on the size required. The typical truss for a 45-foot pole is approximately $400.

The labor cost to install a truss varies depending on the make-up of the crew. The average time required to install a truss is approximately 1 hour for the two installers, including travel, setup, treatment, installation, and cleanup. This time factor assumes that the crew will be installing several units in the same general area.

Fiberwrap

The fiberwrap reinforcement must be performed by an approved contractor. The average cost to install a 6-foot wrap (3 feet above and 3 feet below the groundline) ranges from $1,200 to $1,400. For wraps that must exceed the 6-foot dimension, the additional cost averages $150 per foot. These cost factors assume that the crew will be installing several units in the same general area.

Steel Encasement or Modular Pole

The application of steel encasement or modular pole reinforcement varies depending on field conditions. These units must generally be made up specially for the specific installation. Consult the Electric T&D Engineering, technical support, wood-pole product engineer for assistance in either the steel encasement or modular pole reinforcement.

Pole-Top Restoration

Pole-top restoration techniques vary depending on the specific installation. The cost and time factors are best determined in the field by a QCR. Most woodpecker or crown-damaged pole-top restoration can be completed within 2 hours ($250-$600 per pole) using the repair system indicated in Electric Design Standard 066209, “Repair of Damaged Pole Tops”.

Exhibit D

ANSI Pole Dimension Criteria - Douglas Fir (DF) Poles

Pole Class	1	2	3	4	5	6	H2	H1
Minimum Pole-Top Circumference (inches)	27	25	23	21	19	17 (19)[1]	31	29
Pole Length (feet)	Minimum Circumference 6 Feet From Butt (inches)							
20	31	29.0	27.0	25.0	23.0	21.0		
25	33.5	31.5	29.5	27.5	25.5	23.0		
30	36.5	34.0	32.0	29.5	27.5	25.0		
35	39.0	36.5	34.0	31.5	29.0	27.0		
40	41.0	38.5	36.0	33.5	31.0	28.5		
45	43.0	40.5	37.5	35.0	32.5	30.0		
50	45.0	42.0	39.0	36.5	34.0		50.5	47.5
55	46.5	43.5	40.5	38.0			52.0	49.5
60	48.0	45.0	42.0	39.0			54.0	51.0
65	49.5	46.5	43.5	40.5			55.5	52.5
70	51.0	48.0	45.0	41.5			57.0	54.0
75	52.5	49.0	46.0				59.0	55.5
80	54.0	50.5	47.0				60.0	57.0
85	55.0	51.5	48.0				61.5	58.5
90	56.0	53.0	49.0				63.0	59.5
95	57.0	54.0					64.5	61.0
100	58.5	55.0					65.5	62.0
105	59.5	56.0					67.0	63.0

[1] Class 6 poles in lengths of 35 feet, 40 feet, and 45 feet are purchased with Class 5 (19” minimum) tops.

Exhibit D (continued)

ANSI Pole Dimension Criteria - Western Red Cedar (WC) Poles

Pole Class	1	2	3	4	5	6	H1	H2
Minimum Pole-Top Circumference (inches)	27	25	23	21	19	17 19[1]	29	31
Pole Length (feet)	Minimum Circumference 6 Feet From Butt							
20	33.5	31.5	29.5	27.0	25.9	23.0		
25	37.0	34.5	32.5	30.0	28.0	25.5		
30	40.0	37.5	35.0	32.5	30.0	28.0		
35	42.5	40.0	37.5	34.5	32.0	30.0		
40	45.0	42.5	39.5	36.5	34.0	31.5		
45	47.5	44.5	41.5	38.5	36.0	33.0		
50	49.5	46.5	43.5	40.0	37.5		52.5	55.5
55	51.5	48.5	45.0	42.0			54.5	57.5
60	53.5	50.0	46.5	42.5			56.5	59.5
65	55.0	51.5	48.0	45.0			58.5	61.5
70	56.5	53.0	49.5	46.0			60.0	63.5
75	58.0	54.5	51.0				61.5	65.0
80	59.5	56.0	52.0				63.0	67.0
85	61.0	57.0	53.5				64.5	68.5
90	62.5	58.5	54.5				66.0	70.0
95	63.5	59.5					67.5	71.5
100	65.0	61.0					69.0	72.5
105	66.0	62.0					70.0	74.0

[1] Class 6 poles in lengths of 35 feet, 40 feet, and 45 feet are purchased with Class 5 (19” minimum) tops.

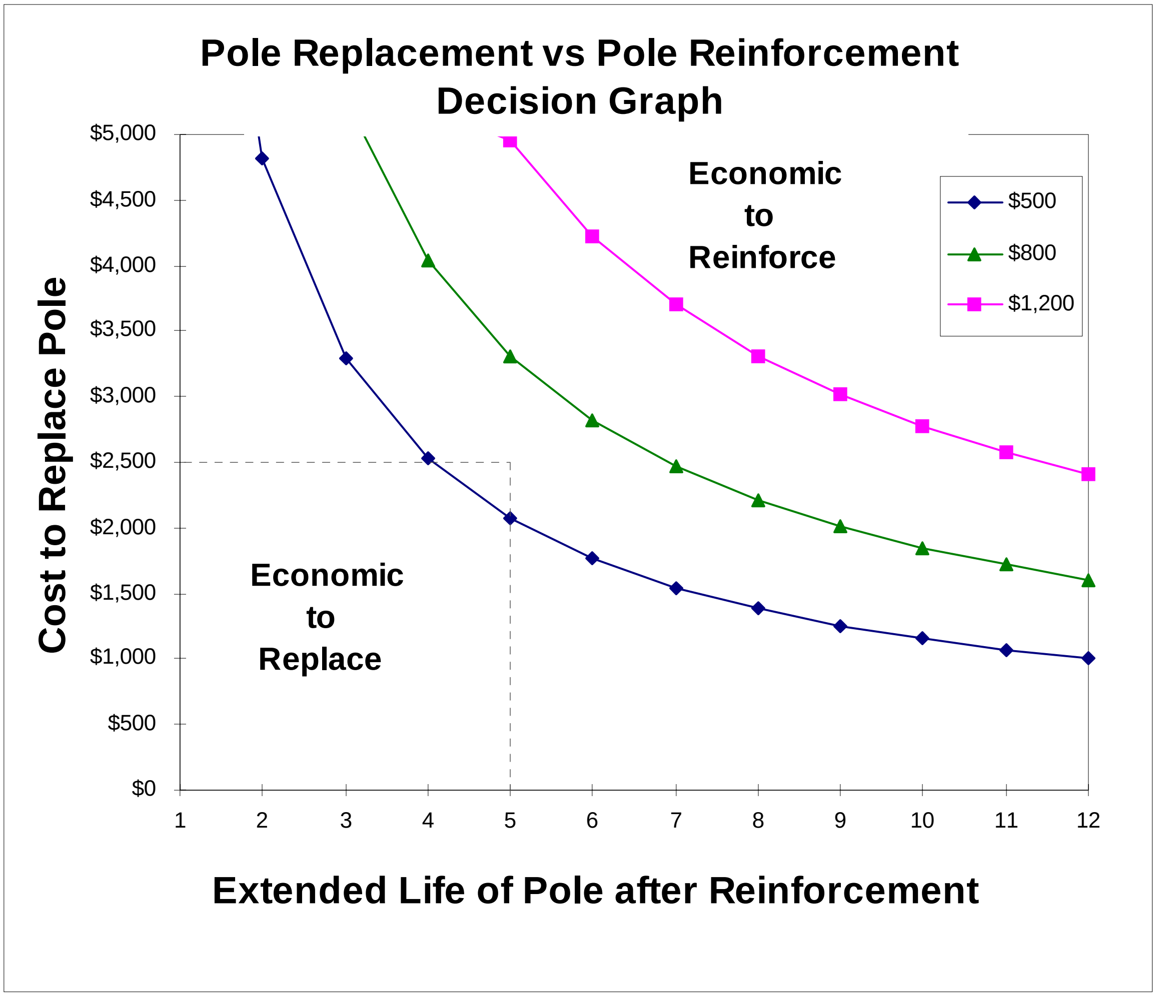
Exhibit E
Changes in Pole Circumference

If the pole circumference has been, or is expected to be reduced from external decay, fire, or mechanical damage, do the following: 1) Measure the original circumference before chipping away decayed wood, or measure at the nearest undamaged point, and 2) Measure the effective circumference at the point of maximum decay or damage. Poles with an effective circumference below the minimum should be reinforced if they meet requirements, or forwarded to estimating for a safety factor calculation and replacement prioritization. 3) In some cases, poles may have to be reclassed using Exhibit D and the pole loading re-evaluated accordingly.

Original Circumference (inches)	Minimum Effective Circumference (inches)[1]
24	21
25	21-3/4
26	22-3/4
27	23-1/2
28	24-1/2
29	25-1/4
30	26-1/4
31	27
32	28
33	28-3/4
34	29-3/4
35	30-1/2
36	31-1/2
37	32-1/4
38	33-1/4
39	34
40	35
41	35-3/4
42	36-3/4
43	37-1/2
44	38-1/2
45	39-1/4
46	40
47	41
48	41-3/4
49	42-3/4
50	43-1/2
51	44-1/2
52	45-1/4
53	46-1/4
54	47
55	48
56	49-3/4
57	49-3/4
58	50-1/2
59	51-1/2
60	52-1/4

[1] For pole circumferences greater than 60", multiply the original circumference by 0.87 to get the resulting minimum effective circumference.

Exhibit F



1. Determine the total pole replacement cost, including all improvements.
2. Determine the expected life of the pole after reinforcement and the cost to reinforce (include any pole improvements). For steel trusses use the $500 curve. Use the $800 curve for 6-foot fiberwrap, and use the $1,200 curve for 10-foot fiberwrap.
3. If the intersection between Step 1 and Step 2 is above the "Cost to Reinforce" curve, it is economical to reinforce the pole.

Example

Assume: 1. Total pole replacement cost = $2,5002.

2. The expected life of pole after reinforcement = 5 years. A steel stub is contemplated.

Result: The intersection of $2,500 and 5 years lies above the "Economic to Reinforce" curve. Therefore, it is economic to reinforce this pole.