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APPROVED

Determining Wood Pole Characteristics

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Maintenance and Inspection

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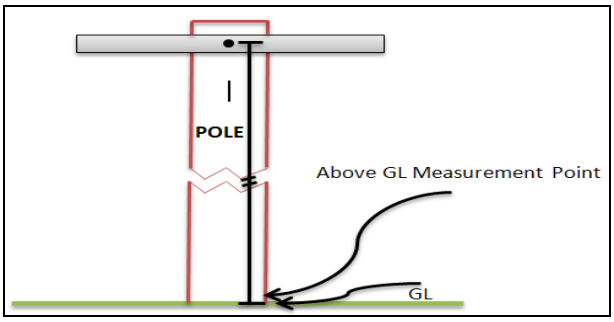
Section 1
Determining Groundline (GL) Location

It is important that a repeatable GL location is determined so consistent measurements can be obtained on all poles. There are two measurement aspects that the GL location impact, accurate GL Circumference and all Attachment Heights above GL measurement point. Attachment height above GL measurement point refers to the point on the pole that is used to measure all attachment points above GL from, see diagram below.

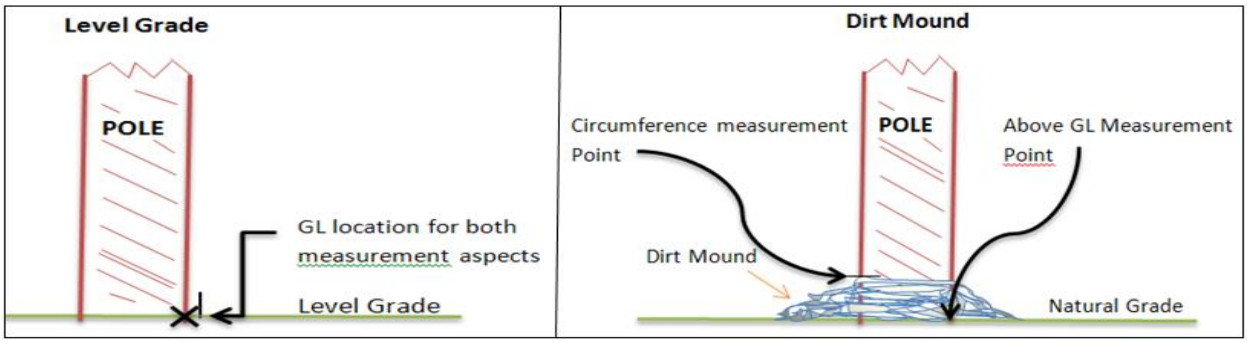
Diagram 1.1: Attachment Height above GL Measurement Point



1.1 Variables to determine GL location

a. *Level Grade*
   i. If the pole is set on level grade the GL will be the point where the pole touches the earth. Both measurement aspects will use this point. (See Diagram Below)

Diagram 1.2 & 1.3: Level Grade and Dirt Mound



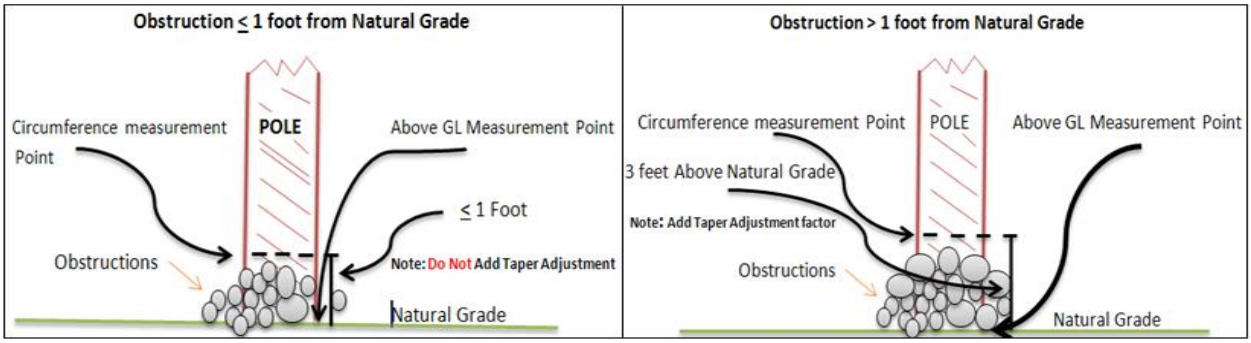
b. *Dirt mound*
   i. The GL circumference measurement will be taken at the top of the mound with no taper adjustment factor (see Section 1.2) added.
   ii. The GL location for measuring heights above GL will be the lowest point at which the natural grade hits the pole. (See Diagram Above)

c. *Level Grades with Obstruction (Example: landscaping, large rock outcrops…)*
   i. The GL Circumference measurement will be taken at the top of obstruction if less than or equal to one foot above the natural grade with no taper adjustment factor (see Section 1.2) added.

ii. If the obstruction is greater than one foot from the natural grade, measure up the pole three feet from the natural grade and take the pole circumference and add the taper adjustment factor (see Section 1.2.)

iii. The GL location for measuring heights above GL will be the lowest point at which the natural grade hits the pole. (See Diagram Below)

Diagram 1.4 & 1.5: Obstructions ≤ 1 foot and Obstructions > 1 foot



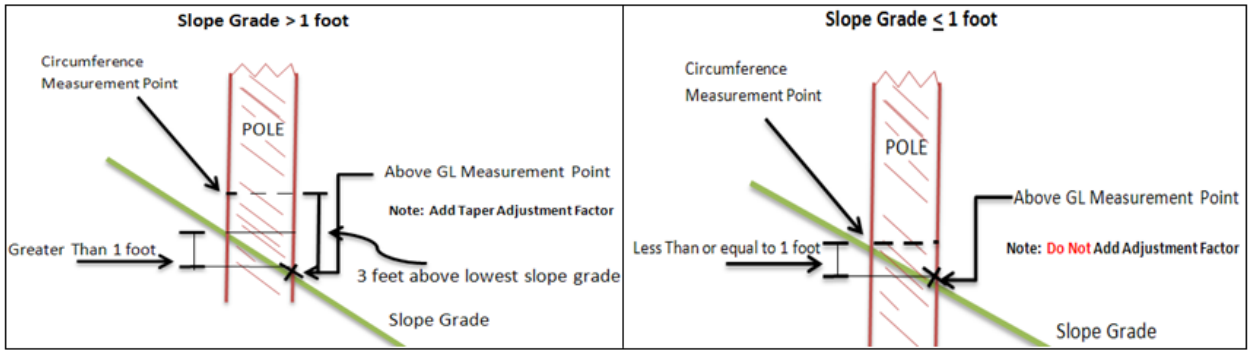
d. *Slope Grade*:

i. The GL circumference will be measured at the highest point at which the slope grade hits the pole if less than or equal to one foot above the lowest slope grade point. No taper adjustment factor (see Section 1.2) will be added.

ii. If the highest point is greater than one foot from the lowest point, measure up the pole three feet from the lowest point at which the slope grade hits the pole and take the circumference and add the taper adjustment factor(see Section 1.2.)

iii. The GL location for measuring heights above GL will be the lowest point at which the slope grade hits the pole.

Diagram 1.6 & 1.7: Slope Grade ≤ 1 foot and Slope Grade > 1 foot



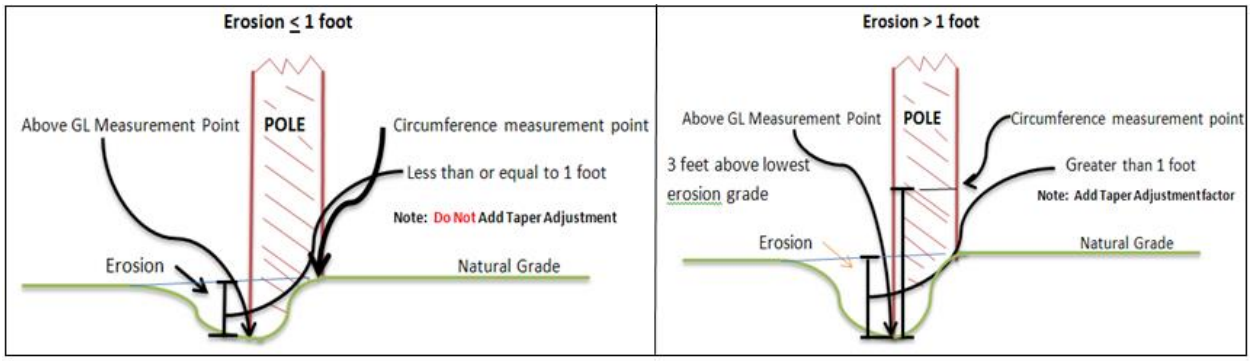
e. *Erosion*:

i. The GL circumference will be measured at the highest point at which the natural grade hits the pole if this point is less than or equal to one foot above the lowest erosion points contact with the pole. No taper adjustment factor (see Section 1.2) will be added.

ii. If the highest point is greater than one foot from the lowest erosion point, measure up the pole three feet from the lowest erosion point and take the pole circumference and add the taper adjustment factor (see Section 1.2.)

iii. The GL location for measuring heights above GL will be the lowest erosion point at which earth contacts the pole.

Diagram 1.8 & 1.9: Erosion ≤ 1 foot and Erosion > 1 foot



1.2 Taper Adjustment Factor

When encountering one of the variables listed above that requires the circumference to be measured three feet above GL, you will need to add the Taper Adjustment factor listed below to determine your GL Circumference.

Circumference at 3 Foot AGL + Taper Adjustment Factor = Adjusted GL Circumference

Table 1.1: Taper Adjustment Factors

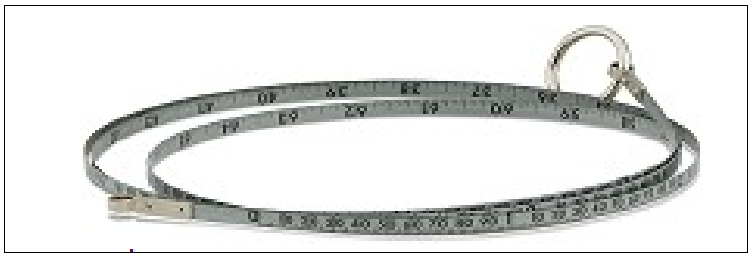
Taper Adjustment Factors		
Douglas Fir	Western Red Cedar	Pine (All)
1/2 inch	1 inch	1/2 inch

Note: After determining the proper location to measure the circumference, proceed to Section B (Measuring GL Circumference). If unable to measure the GL circumference three feet above the determined above GL measurement point, default to class minimum.

Section 2
Measuring GL Circumference

To measure GL circumference, wrap the Loggers tape (see Photo below) around the pole. The tape should be perpendicular, or 90 degrees to the pole. This measurement needs to be taken as close to the ground line as possible. See section A (Determining GL Location) to determine the proper GL location.

Photo 2.1: Loggers Tape

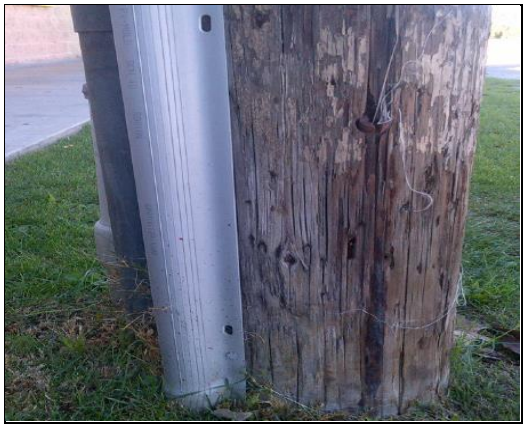


2.1 Determining GL circumference by one of the three categories listed below

SAFETY NOTE: Prior to measuring GLC, ensure there is no exposed conductor at base of pole. If exposed conductor is found at base of pole, perform measurement at 3 feet AGL, if no exposure issue exists at the 3' AGL level, and it is safe to do so. Notify SCE rep to have repair notification created for exposed conductor.

a. *Full Measurement:*
   i. No obstructions on pole: Tool: Loggers Tape
   ii. If risers are present, measure behind the risers to get a clean GL circumference.
      1. If unable to get a clean measurement due to obstructions (risers), proceed to section A.1.b. "Partial Measurement" below.
   iii. If a U-Guard riser (See picture below) is on the pole, for safety reasons do not measure behind the U-Guard riser. Proceed to section B.b.ii. "Partial Measurement" below.

Photo 2.1: U-Guard



iv. If there is a wood ground molding, for safety reasons do not measure behind the molding. To remedy this situation, measure over the top of the wood ground molding and subtract ¾ of an inch from the measured circumference of the pole.

v. If there are more than one wood ground molding, step iv above applies as long as there is enough separation between the moldings so that the tape touches the pole on both sides of every molding. If you are unable to regain contact with pole between the wood ground moldings proceed to the partial measurement section below.

b. Partial Measurement:

i. Obstruction on pole: Tools: Loggers tape and caliper

ii. More than one riser and/or U-Guard on the pole that cannot be measured behind
    1. First measure the available surface of the pole between obstructions
    2. Second, caliper the width of the riser and/or U-Guard (Obstructions)
    3. Add the measurements together

    Available Surface + Calipered Obstructions = GL Circumference

iii. If there are wood ground moldings on the pole that you cannot measure with the tape touching the pole on both sides of every molding, measure the available surface of the pole and add 1 inch for every wood molding. Wood ground moldings do not need to be calipered to obtain their width.

c. Unable to Measure (Spida Calc will provide the ANSI minimum) (steel stubbed, fiberglass wraps and others):

i. If you are unable to measure the GL circumference, default to class minimums.

Section 3
Determining Wood Species, Length, and Class with Visible Brand

If the brand is ***visible*** on the pole, the pole assessment will always use the data provided by the brand.

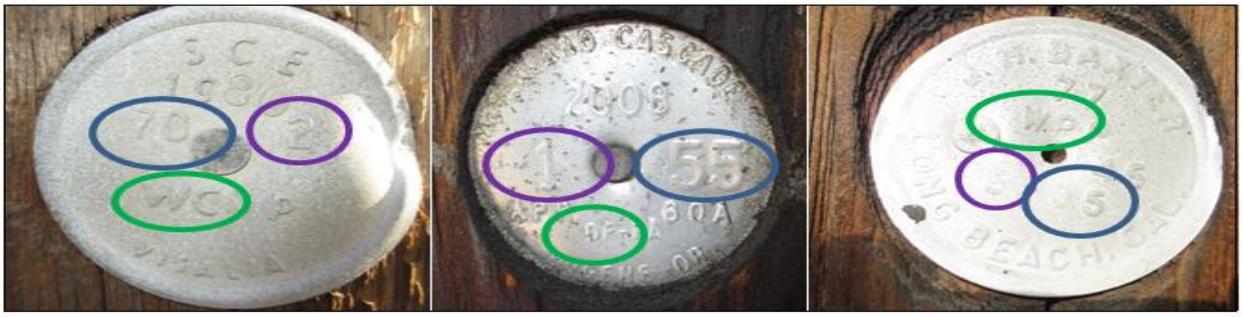
Brands often come in two different types. The brand may either be burned onto the pole, or appear as a medallion nailed to the pole. The pole brand is typically located on the same side of the pole as the cross arm gain at the top of the pole.

The pole brand will give three primary pole characteristics needed for pole load assessment:

1. Species
2. Class
3. Pole Length

3.1 Identifying Characteristics on Medallion Brands

Photo 3.1, 3.2, and 3.3: Characteristics on Medallion Brands



Species: WC = Western Cedar
Class: 2
Length: 70 feet

Species: DF = Douglas-fir
Class: 1
Length: 55 feet

Species: WP = Western Pine
Class: 5
Length: 35 feet

3.2 Identifying Characteristics on Burned Brands

Photo 3.4, 3.5, and 3.6: Characteristics on Medallion Brands

Species: WC = Western Cedar
Class: 1
Length: 75 feet

Species: DF = Douglas-fir
Class: 5
Length: 45 feet

Species: SP = Southern Pine
Class: 4
Length: 45 feet

If the pole brand is not on the pole, the species, class, and pole length will need to be determined. The first characteristic that should be determined is the pole species. Proceed to Pole Identification without Brand Section.

Section 4
Determining Wood Species, Length, Year Set Date, and Class without a Visible Brand

The wood species, length, and class of the pole only need to be determined by the pole loader, if a pole brand is not available.

4.1 Determining Wood Species of Pole

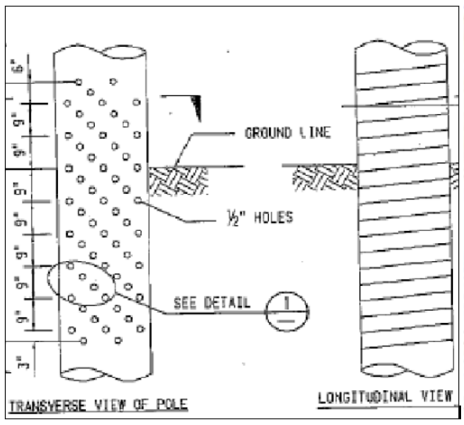
a. Through-Bored Poles are always Douglafir

i. To determine whether the pole is through-bored, a pattern of ½ inch holes extending 18" – 24" above ground line will be visible (See Photos below). The holes will be drilled in a diagonal pattern that extends through the pole.

Note: These holes are not to be considered damage to the pole.

Photo 4.1 and 4.2: Through-bored Poles

Diagram 4.3 and Photo 4.4: Through-boring



ii. If you find this condition, then the pole is a **Douglas Fir**.

iii. If through-boring does not exist, then proceed to increment boring below.

b. *Increment boring* will be performed using the increment bore tool (See Photo below).

Photo 4.5: Increment Bore

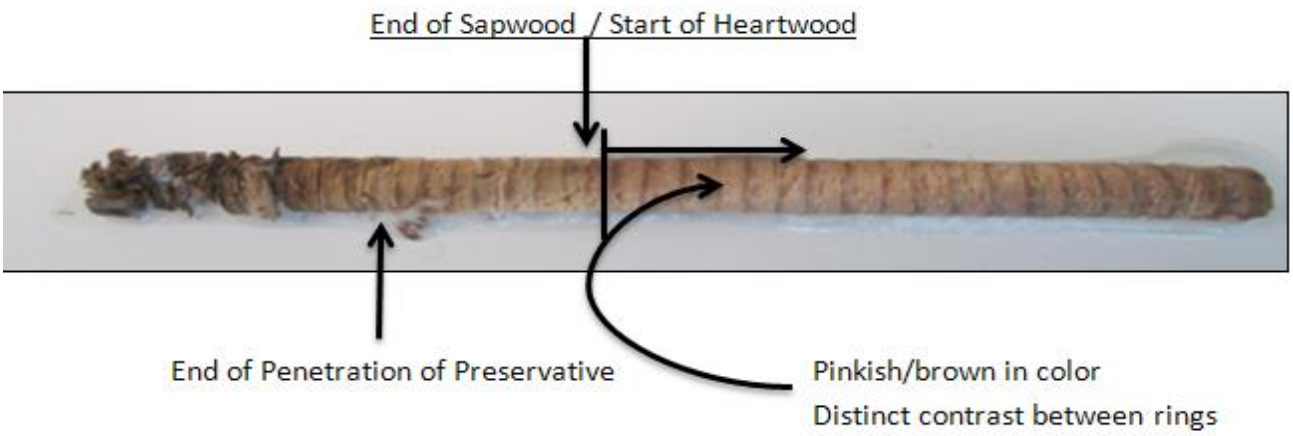
i. The increment bore will provide you with a core sample of the pole. The best core sample is typically provided by a solid section of wood. It is important to avoid boring into cracked portions, as this may provide a partial sample, thus making the species more difficult to identify.
ii. Be sure to bore to a minimum of 3” to 4" into the pole.
iii. There are three characteristics that will help in determining the wood species when analyzing the core sample, they are the:
    1. Depth of sapwood and penetration of preservative
    2. Clarity of growth rings
    3. Coloration

4.2 Core Identification

a. Douglas-Fir

i. Sapwood is the outer portion of the pole which is treated with preservative. The typical depth of sapwood on Douglas-fir poles is 3/4 to 2 inches. Doug-fir sapwood is yellowish/light brown in color when untreated.
ii. Douglas-fir Heartwood is pinkish/brown in color. Douglas-fir heartwood contrasts with the sapwood in color and is virtually impermeable to preservatives. The growth rings will have a distinct contrast between early wood (pinkish in color) and late wood (brown in color). Douglas-fir cores will have a smoother surface than cedar.

Diagram: 4.1: Douglas-fir Core

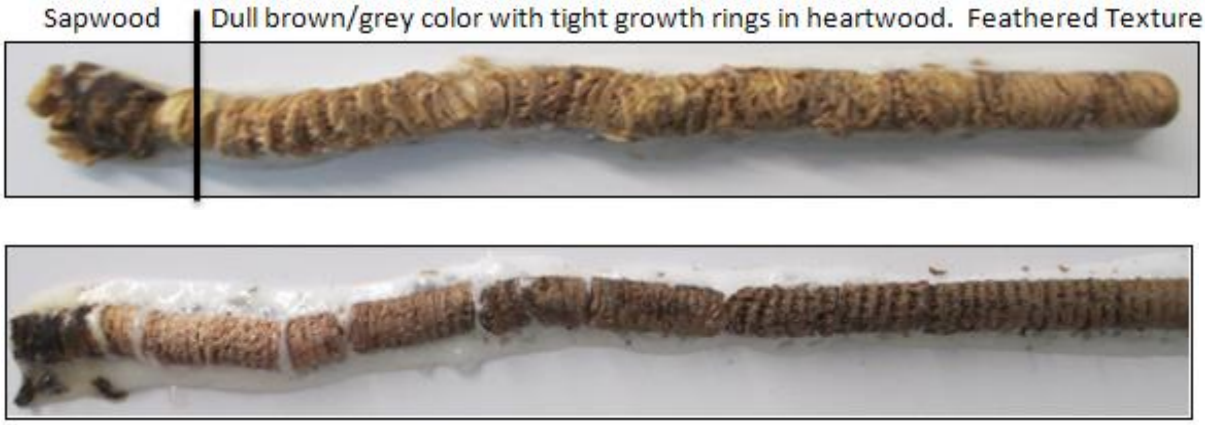


b. *Western Red Cedar*

i. The typical depth of sapwood on cedar is 1/4 to 1/2 inch in depth. Western red cedar sapwood is yellow to white in color when untreated.

ii. Heartwood is dull brown to gray in color. Cedar heartwood does not contrast with the sapwood in color as much as Douglas-fir and is virtually impermeable to preservatives. Growth rings will not have a distinct contrast between early wood and late wood. Western red cedar growth rings have tighter spacing and a more feathered texture than Douglas-fir and Pine poles.

Diagram / Photo: 4.7 and 4.8: Western Red Cedar Cores



c. *Southern Pine*

i. The typical depth of sapwood on Southern pine poles is 3 to 5 inches in depth. Your core should only consist of sapwood and have full penetration of preservative. Southern Pine cores will appear to be yellow to tan in color.

ii. The growth rings will have a distinct contrast between early wood and late wood. The late wood which is narrower in width will have a tanner color. Southern Pine cores will have a smoother oily surface (full penetration of preservative).

Diagram: 4.9: Southern Pine Cores

Diagram: 4.10: Southern Pine Cores

d. Western Pine

i. The typical depth of sapwood on Western Pine poles is 3 to 5 inches in depth. Western Pine core should only consist of sapwood and have full penetration of preservative. Western Pine cores will appear to be yellow to tan in color.

ii. The growth rings will have a distinct contrast between early wood and late wood. Western Pine cores will have distinct light yellow color starting ¾ to 1 inch in depth beyond the outer surface.

Diagram: 4.11: Western Pine Cores Sample

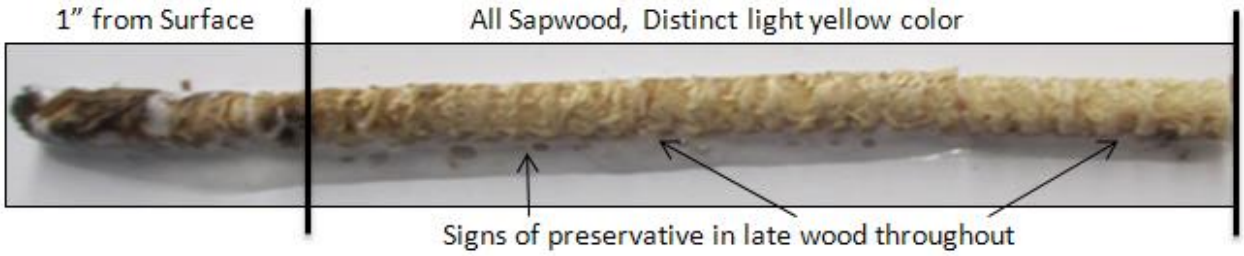


Photo: 4.12: Western Pine Cores Sample

4.3 Determining Length of Pole

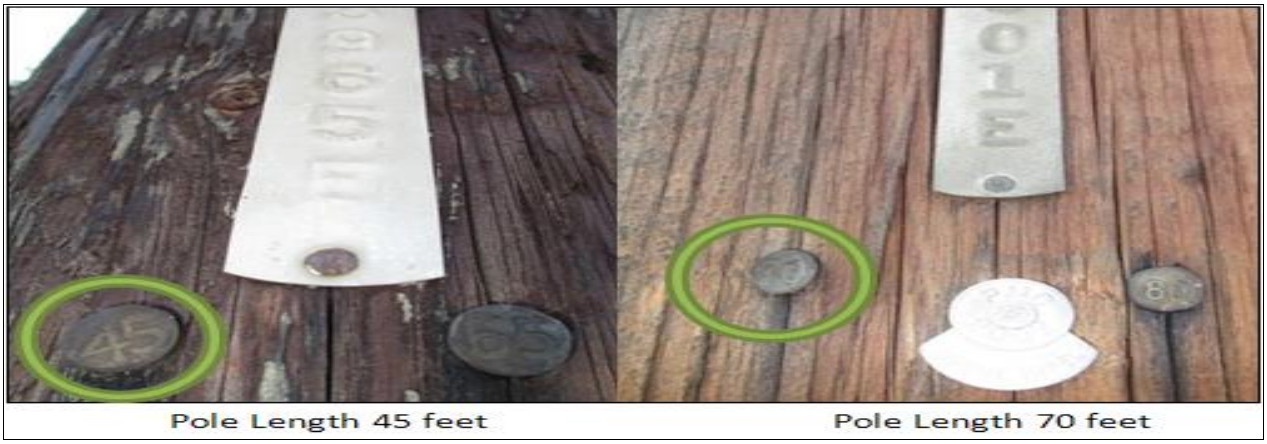
a. Look for the length nail. If one exists, it would generally be found below the pole tag. There are generally two nails. The one to the left identifies the pole length and the one on the right identifies the year the pole was set (See Section D.3. for determining the year the pole was set).

i. If there is no pole tag, the nails are typically found on the street-facing side of the pole.

Photo: 4.13 and 4.14: Location of Nails and Length nail

Located below Pole Tag | Pole Length 50 Feet

Photo: 4.15 and 4.16: Length nail



Pole Length 45 feet | Pole Length 70 feet

b. If the length nail is not present:
    I. Utilize the true pulse 360 to measure the height above ground line.
        1. Use the GL location determined in Section 1 with a known vertical offset from this point for angle 1.
        2. For Angle 2, shoot the tip of the pole to determine the tip's height above GL.
        3. After establishing the tip's height above GL, use the table below (determining pole length from Tips Height above GL) to determine the accurate pole length.

POLE HEIGHT	Measured height above GL if Set in ground 10%+2'	Measured Height above GL if set 10%+1.5' in ground
25	20.5	21
30	25	25.5
35	29.5	30
40	34	34.5
45	38.5	39
50	43	43.5
55	47.5	48
60	52	52.5
65	56.5	57
70	61	61.5
75	65.5	66
80	70	70.5
85	74.5	75
90	79	79.5
95	83.5	84
100	88	88.5
105	92.5	93
110	97	97.5
115	101.5	102
120	106	106.5

4.4 Determining Pole Year Set

a. Look for the year set nail.
   i. If one exists, it would be found below the pole tag and to the right.

Photo: 4.17 and 4.18: Date Set Nail nail

Pole Year Set Date 1965 Pole Year Set Date 1980

b. If there is no date nail or record is recorded in SAP, *you need to determine if the pole was set prior to 2000 or after January 1, 2000.*

i. All Western Red Cedar, Western Pine, and Southern Pine Poles were set prior to 2000.

ii. If Douglas Fir pole is Through-bored, assume pole was set after January 1, 2000.

iii. If Douglas Fir pole is not Through-bored assume the pole was set prior to 2000.

4.5 Determining Class of Pole

a. Poles set prior to 2000

i. Use the 'Rule of Thumb' table below.

Table: 4.1: 'Rule of Thumb'

Rule of Thumb	
Pole set Prior to 2000	
Length of Pole	Correct Class
25	5
30	5
35	5
40	5
45	4
50	4
55	3
60	2
65	2 & 1
70	2 & 1
75	2 & 1
80	2 & 1
85	2 & 1
90	2 & 1
95	2 & 1
100	2 & 1

iv. Determining Class for Poles 65 feet in length and larger. Considering there are two classes to choose from (Class 2 & 1) you will need to use the minimum GL Circumference tables below.

1. You will need the circumference of the pole, species of the pole, and the length.
2. *If the* circumference of the pole meets or exceeds the minimum circumference for a Class 1, a Class 1 will be recorded.
3. *If the* circumference of the pole does not meet the minimum circumference for a Class 1, a Class 2 will be recorded.

Table: 4.2: Douglas-fir Minimum GL Circumference Table

Douglas-fir Minimum Groundline Circumference

Pole Length	Min Top Circum. (inches)	Class H6	H5	H4	H3	H2	H1	1	2	3	4	5
		39	37	35	33	31	29	27	25	23	21	19
25												25.8
30												27.7
35								40.9	37.9	35.0	32.5	29.0
40				51.0	48.5	46.0	43.5	41.0	38.5	36.0	33.5	*31.0*
45			55.8	53.3	50.8	48.3	45.3	42.8	40.3	37.3	*34.8*	32.2
50			58.0	55.0	52.5	50.1	47.1	44.6	41.6	38.6	*36.1*	
55			59.8	57.3	54.3	51.4	48.9	45.9	42.9	*40.0*		
60		64.5	61.6	58.6	56.1	53.1	50.2	47.2	*44.3*			
65		66.3	63.3	60.4	57.4	54.5	51.5	*48.5*	*45.6*			
70		67.6	65.1	62.2	59.2	55.8	52.8	*49.9*	*46.9*			
75		69.4	66.4	63.5	60.5	57.6	54.2	*51.2*	*47.8*			
80		70.7	67.7	64.8	61.9	58.4	55.5	*52.5*	*49.1*			
85		72.5	69.5	66.1	63.2	59.8	56.8	*53.4*	*50.0*			
90		73.8	70.9	67.4	64.5	61.1	57.7	*54.3*	*51.3*			
95		75.3	72.4	69.0	65.6	62.6	59.2	*55.3*	*52.4*			
100		76.9	73.9	70.5	67.1	63.7	60.2	*56.8*	*53.4*			

Western red cedar Minimum Groundline Circumference

Pole Length	Min Top Circum. (inches)	Class H6	H5	H4	H3	H2	H1	1	2	3	4	5
		39	37	35	33	31	29	27	25	23	21	19
25												28.5
30												30.2
35								40.9	37.9	35.0	32.5	32.0
40				56.5	53.5	51.0	48.0	45.0	42.5	39.5	36.5	*34.0*
45			61.7	58.7	55.7	53.2	50.2	47.2	44.3	41.3	*38.3*	35.8
50			63.9	60.9	57.9	54.9	52.0	49.0	46.0	43.0	*39.6*	
55			66.1	63.1	60.1	56.7	53.7	50.8	47.8	*44.3*		
60		70.8	67.8	64.9	61.9	58.4	55.5	52.5	*49.1*			
65		73.0	70.0	66.6	63.6	60.2	57.3	*53.8*	*50.4*			
70		74.7	71.8	68.4	65.4	62.0	58.5	*55.1*	*51.7*			
75		76.5	73.5	70.1	66.7	63.3	59.9	*56.4*	*53.0*			
80		78.3	74.8	71.9	68.5	65.1	61.2	*57.7*	*54.3*			
85		80.0	76.6	73.2	69.8	66.4	62.5	*59.1*	*55.2*			
90		81.8	78.4	74.5	71.1	67.7	63.8	*60.4*	*56.5*			
95		83.4	79.9	76.5	72.6	69.2	65.3	*61.4*	*57.6*			
100		84.9	81.5	78.1	74.2	70.3	66.9	*63.0*	*59.1*			

b. Poles set after January 1, 2000

i. When the length and circumference are known for an existing pole set after January 1, 2000, use the table for **Douglas-fir Poles** shown above to determine the Class.