Patterson & Dewar Engineers

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Proudly serving electric utility, cooperative & municipal clients since 1945

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Does Quality Construction Just Happen?

Every day should be a new day to perform top quality work, no matter what it is you do, or that's what we think, don't we? In general, most of us strive to do a quality job every day. A few years ago one of our auto manufacturers made up an advertising slogan emphasizing quality, "Quality is Job 1". But how do we really know that we are doing a quality job? Do we regularly have someone review our work to make sure that what we are doing is top quality? Even if we do, do we like it? After all, it isn't always comfortable to have your work reviewed and to have someone else tell you that something that you were doing isn't the best way, especially if you have been doing it that way for years.

Building power distribution lines is work that is crucial to the safe and cost effective operation of any electric utility. Often that work is done in all types of weather and in all types of situations, be it during storm restoration, new construction, line extensions or system improvements. How do you know that the power distribution lines on your system are being constructed with quality? One way is to have a periodic review by an "outside" source. "Outside" means someone not associated with the actual construction process or not from within the company. This type of outside review may not be popular with construction crews, those doing line staking or those responsible for those functions.

For electric utilities that are RUS (Rural Utilities Service) borrowers, "outside" review is required by RUS, if not outside of the company, then at least outside of those involved with the construction. In fact, RUS requires on its inventory of work orders (RUS Form 219) that the licensed engineer signing that inventory certify that "sufficient inspection has been made of the construction…to provide reasonable assurance that the construc-

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Does Quality Construction Just Happen? Continued from pg. 1

tion complies with applicable specifications and standards and meets appropriate code requirements as to strength and safety." (Code of Federal Register, CFR 1724.32) Further, CFR 1724.32 requires that the field inspection be performed within 6 months of the construction by a licensed engineer or his subordinate; that the inspection include a representative and sufficient amount of the construction listed; that the inspected work orders be noted on the Form 219; that the inspection determine that the construction conforms to RUS specifications and National Electrical Safety Code (NESC) requirements; that the staking sheets represent the construction completed and inspected; that clean-up notes and staking sheet discrepancies be noted and re-inspection of the corrections performed; and that the staking sheets or as-built drawings be noted, initialed, and dated.

Probably the most difficult part of the above CFR charge is how much inspection is really necessary to meet the "sufficient inspection" requirement. In a 1991 paper, RUS provided the opinion that 30% of the total construction cost listed should be inspected and that 15% of the total number of work orders should be inspected, to be considered sufficient inspection.

In addition to the inspection review process, Patterson & Dewar Engineers has found it beneficial and very helpful to speak with the construction crews and line stakers to discuss common and re-occurring problems and encourage a high quality of construction. Our desire and intent is to assist our clients in making "Quality is Job 1". ❖

Oil Spill: One Example

Feb-15-2005

One of our clients had an oil incident recently.

The Spill:

A construction dump truck hit a line that knocked down a pole with three 75 kVA transformers on it. The pole fell in a parking lot, broke open the transformers and spilled a combined 100+ gallons of oil.

The Response:

The utility was called. The utility personnel mobilized quickly and helped to temporarily dam up the oil until the trucking company, which caused the incident, could mobilize a cleanup contractor.

Cleanup approach:

The cleanup contractor applied peat moss to absorb the oil and swept up the peat with a rotating brush on a "bobcat" type vehicle.

Notable points:

1-The utility mobilized quickly and kept the oil from reaching water in a nearby stream.

2-The quantity of oil was below the threshold of oil response that required an SPCC plan and secondary containment.

3-The sorbent materials and fast response approach gave the utility the flexibility to respond to this situation.

4- Spills get a great deal of attention from the public these days. Two separate non-utility people called the EPA to report the spill. The EPA does not have to be notified for a small spill such as this, if the spill does not reach water. The utility called as a courtesy to give the EPA an update. ❖

Height Effect on Wood Pole Fiber Stress continued from pg. 4

For multi pole H-frame and angle structures that are X braced the effect will be that the maximum allowable span may be reduced by as much as 25%. Normally the point of maximum fiber stress on an X-braced structure is at or near the X-brace attachment. These attachments are normally in the top half of the above ground portion of the structure, where the maximum fiber stress has been reduced by 25%. H-frame structures are complex structures and have many components that could control the design. Provided the strength of the pole is the limiting factor then the result would be as much as 25% reduction in structure strength. Instead of reducing the span length, a heavier class of wood pole can be used. It appears that normally a one or two classes heavier pole will be required in these applications.

These changes to the ANSI O5.1 standard will make the comparison between wood and "wood pole equivalent" steel and concrete poles more difficult as there will not be a direct conversion between them. This change may make steel or concrete a more economical solution than wood in the future.

The 2002 NESC references the ANSI O5.1-1992 specification for designated fiber stress. If the design criterion is to meet NESC-2002, then the revisions of ANSI O5.1-2002 do not come into play. However, if the design criterion includes meeting the requirements of ANSI O5.1, then the revisions to ANSI O5.1-2002 would need to be met by the design. The real effects of this change will not be fully known until the 2007 edition of NESC is published. NESC could decide not to accept the 2002 changes to ANSI O5.1 or they may change the strength factor for wood poles to reduce the impact of this change.

Patterson & Dewar Engineers can assist you in all your structural needs from analyzing individual structures to reviewing your current standards for compliance with the new ANSI O5.1 and NESC requirements to complete line design. ❖

P&D People

We welcome a new member to the P&D family, Gary Grubbs. Many of you with ties to Kentucky already know Gary very well, as Gary most recently was the Division Director of the Engineering Division at the Kentucky Public Service Commission (KPSC), where he was promoted after being Manager of the Electric Branch of the KPSC. Before his service at the KPSC, for fourteen years Gary had been at Farmers RECC in Glasgow, Kentucky, in many positions in engineering and operations, with his last being as VP of Electric Operations. He started his engineering career at Tri-County EMC in Lafayette, Tennessee, rising to the position of Manager of Engineering after fifteen years of service. Gary is a University of Kentucky EE grad who will continue to make his home in Glasgow, Kentucky, with his wife, Pamela, and his two children. We look forward to Gary's being part of our team, serving our Kentucky clients and many others in the region. Best of luck, Gary! ❖

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Height Effect on Wood Pole Fiber Stress

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By Jerry G. Crawford P.E.

In the 2002 revision of the ANSI O5.1, American National Standard for Wood Products, Specifications and Dimensions, a new section was added to the body of the specification. This new section (section 9) gives a formula to use for calculating the fiber stress depending on the height above groundline. The fiber stress at groundline is the same as in earlier editions of the standard, but per the 2002 revision the fiber stress will reduce as you move up the pole.

Per the latest revision of ANSI O5.1 the fiber stress in a wood pole is to be calculated using the following equation:

$F_2 = F_1 (1-0.5 H/L)$

where:

F_1 is the tabulated allowable fiber stress value;

F_2 is the calculated fiber stress value at distance H;

H is the distance from groundline to point above ground where fiber stress is F2 (maximum value of H can be L/2); and

L is the length of pole from groundline to top of the pole.

This will reduce the wood pole fiber stress from the maximum at groundline to 0.75 times the maximum at midway up the pole. The fiber stress will remain at this level to the top of the pole. The following example will demonstrat the effects of the change in allowable fiber stress:

Example:

You are installing a 45′ southern yellow pine pole set 6.5′ deep. The above ground length (L) will be 38.5′ (45′ – 6.5′). At groundline the maximum fiber stress can be 8000 psi (from Table 1 of O5.1). The fiber stress will reduce from groundline to the mid point of the above ground length, at 19.25′ (L/2). At 19.25′ above groundline the fiber stress is calculated as follows:

$$F_2 = F_1 (1-0.5 H/L)$$

$$F_2 = 8000\text{psi } (1-0.5 (19.25/38.5))$$

$$F_2 = 6000 \text{ psi}$$

From the mid point of the above ground length to the top of the pole the fiber stress will be 6000 psi instead of 8000 psi per previous revisions of the specification.

This equation has been in the Appendix of ANSI O5.1 for many years as a suggested formula to use when you are working with actual measured circumferences. In moving the equation to the body of the specification and removing the reference to actual measured circumferences, the standard seems to indicate that this equation should be used in all designs.

What is the effect of this standard change?

For the purpose of this article a single point load was applied at two feet below the top of the pole to compare the effects of this change to the O5.1 Standard. Properties for Southern Pine poles were used for all calculations. Calculations were done with a nonlinear structural analysis program.

For single pole and unbraced H-frame tangent structures the effect is more severe on larger and taller poles. On a 45′ Class 2 pole the change reduces the allowable load at the pole top by about 18% but on a 75′ Class 2 pole the allowable load was reduced by about 30%.

On single pole guyed structures the effect will vary depending on line angle, conductor tension, guying angle, and number of guys. Since the highest stressed point in the pole is normally in the upper portion of the pole the allowable load could be reduced by as much as 25%.

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