North American Wood Pole Coalition
TECHNICAL BULLETIN

Case history of a pole purchase: Brunswick EMC's Oak Island distribution line

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OVERVIEW

When Brunswick Electric Membership Corporation upgraded a 5.2-mile distribution line, the engineering department and a consultant considered various pole alternatives. The choice, however, was clear. Unlike in Grade B construction, there is not direct interchangeability of pole types in NESC Grade C and Extreme Wind design. Specifying treated wood saved the utility $115,000.

In upgrading 5.2 miles of distribution line, Brunswick Electric Membership Corporation evaluated various new products and specified some of them, but the choice of a traditional product – wood poles – saved a surprising $115,000 for the coop.

Brunswick EMC, founded in 1939, is North Carolina's third largest coop. Headquartered in Supply, the cooperative serves 58,164 members with a net utility plant of $113,896,347.00. The cooperative's average density is 12.22 consumers per mile. Brunswick EMC's service territory includes several barrier islands near Wilmington, NC, including Caswell Beach, Oak Island, Holden Beach, Ocean Isle Beach, and Sunset Beach. The cooperative maintains 178 miles of transmission, 1309 miles of underground distribution, and 3247 miles of overhead distribution.

In order to meet its consumers growing energy demands on Oak Island, Brunswick EMC petitioned the Town of Oak Island for permission to build a new substation and transmission line on the island. This would have provided higher electrical capacity and more reliable service by allowing a transmission loop feed, or two-way feed, from the mainland. However, the community rejected the cooperative's proposal.

With the substation and transmission line proposal denied, Brunswick EMC had to devise an alternate plan to maintain reliable service to Oak Island.

Brunswick EMC enlisted the services of Electrical Consulting Engineers, Inc. (ECE), a Charlotte, North Carolina-based consultant, to find a solution. After evaluating their options, it was decided that the best solution would be to construct a new substation on the mainland, build a new large capacity 12.47kV distribution tie line from the new station to the island, and upgrade 5.2 miles of existing 12.47kV distribution line.

The critical decision was one that has become common for all utilities: how to best balance reliability with cost.

To meet the forecasted long-range energy demands, the upgraded distribution line was designed for a double circuit using 559 AAAC conductor. For maximum reliability and minimal visual impact, a narrow profile construction design was chosen. Post insulators made of silicone were selected to reduce the problems from salt contamination. Since the existing poles were located on property lines, reducing the span lengths was not an option. Therefore, the line design had to facilitate 250 – 310 foot spans. The total 5.2-mile distribution upgrade would require the use of 100 poles, 50 feet in length, and 10 poles, 55 feet in length.

As is typical for distribution lines, the National Electrical Safety Code minimum grade of construction required for this new line would be Grade C. Under NESC Rule 250B the coop is considered to be in the Medium Ice Loading zone which requires load calculations to assume 4 lbs/sq. ft. of wind and _" of radial ice on the conductor. However, because of the line's coastal location, recent weather events, and the fact that this line was going to be a primary artery for Oak Island, the decision was made to also consider the loading requirements in NESC Rule 250C for Extreme Wind Loading. Oak Island is in a 100 mph (26 lbs./sq. ft.) wind zone on the ASCE 50 year (.02 probability) Extreme Wind Map. In the past few years, Oak Island has experienced such forceful winds on the three occasions – during hurricanes Bertha and Fran in 1996 and Bonnie in 1998. The appropriate overload factors were applied, and the extreme wind design was more stringent than that for medium loading. Therefore, this project was designed for extreme wind conditions.

Brunswick EMC serves areas of diverse densities within Brunswick and Columbus counties. When designing distribution lines, the cooperative periodically evaluates new technologies that can improve the project's reliability and cost. Though previously Brunswick EMC had purchased only treated wood poles for its distribution lines, the cooperative investigated the economics of using steel or concrete poles for this project.

ECE has been evaluating pole alternatives for transmission and distribution projects for many clients. They recognize that steel and concrete pole classes that are designed to be "wood pole working load equivalent" in NESC Grade B construction applications are not directly interchangeable in Grade C or

Extreme Wind conditions. Therefore, ECE evaluated the three pole types with the loading conditions for this project.

The Overload Factors in NESC Table 253-1 (1997) were divided by the Strength Factors for the appropriate material in Table 261-1A to obtain the total overload factor to be used for each pole type. For Extreme Wind Loading designs, NESC Rule 250C, the total overload factors were found to be 1.0 for concrete and steel poles and 1.33 for wood. The Minimum Ultimate Resisting Moments for all three pole types were combined with the appropriate overload factors to obtain the Total Allowable Working Loads. The wood pole ultimate strengths were calculated using the wood fiber stresses and minimum groundline circumferences from ANSI 05.1-1992 Tables 1 and 8 respectively. By industry standard, the steel and concrete pole ultimate strengths are 2.5/4.0 or 62.5% of the wood pole ultimate strength for the same height and class pole.

The pole strength calculations showed that the 250-310 ft. spans included in this project would require 100 – 50 ft. class H2 and 10 – 55 ft. H3 steel or concrete poles (actual maximum allowable spans = 292 ft. and 331 ft. respectively). If wood poles were to be used, the project would require 100 – 50 ft. class H1 and 10 – 55 ft. class H2 poles (actual maximum allowable spans = 295 ft. and 341 ft. respectively).

Quotes were received for concrete poles, CCA-treated wood poles and light duty steel poles (thin-walled steel poles were not available in these sizes). The lowest prices quoted (mid 1997) were:

Steel	100 – 50/H2 @ $1491 ea.	10 – 55/H3 @ $1832 ea.
Concrete	100 – 50/H2 @ $1500 ea.	10 – 55/H3 @ $1749 ea.
Wood	100 – 50/H1 @ $ 432 ea.	10 – 55/H2 @ $ 867 ea.

These prices result in the following total pole costs:

Steel	$167,420.00
Concrete	$167,490.00
Wood	$ 51,870.00

The difference in the cost was staggering. In order to reach a decision, Brunswick EMC and ECE had been expecting to compare the advantages and disadvantages for using each type of pole. However, with such a large cost difference, the other factors became less significant.

The choice of wood over steel or concrete saved more than $1,000 per pole. Based on the total cost of poles for the project, Brunswick realized a savings of over 220% (more than $115,000) by staying with traditional poles made of treated wood. The CCA-treated poles were delivered directly to the job site, with all phases of construction completed in 1998.

The Oak Island Project exemplifies the philosophy of Brunswick Electric Membership Corporation. The decision to design this project for Extreme Wind Loading conditions, and to use silicone insulators with treated wood poles, reflects Brunswick's commitment to provide its consumers with the highest level of reliability at the lowest cost.

Disclaimer

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