Power Generation

More Than Just Hanging Around

Composites offer solutions to utility line challenges

By Richard Stewart

A utility crew sets a new composite pole in this distribution line. Owing to its lightness, the composite pole is much easier to install than wood or other heavier poles.

A properly maintained wood utility pole can last 35 years or longer, according to the U.S. Forest Service, which estimates that more than 160 million wood poles are in service in North America alone. But oftentimes, the service life of a wood pole is cut short by natural enemies, such as woodpeckers, termites, rot, fire, high winds and excess loading. For that reason, steel and concrete poles have been incorporated into the power grid. And slowly but steadily, FRP composite poles, typically pultruded or filament-wound hollow tubes, are making their mark in the utility industry. That mark tends to be increasingly durable, with an estimated service life of 80 years.

The American Composites Manufacturers Association (ACMA) Utility and Communications Structures Working Group (UCSWG) has done extensive research and developed strategies for promoting FRP poles and crossarms to utilities, public utility commissions and others who specify and purchase these products. The group's primary objective is to convince users to evaluate composites based on life-cycle costs rather than initial purchase price, according to Brian Lacoursiere, chairman of the working group and senior VP sales & engineering of Chicago-based FRP pole supplier Duratel.

Composite utility poles were first installed during the early 1950s in Hawaii, where termites make short work of wood poles, giving them an average eight years of service life, relates Lacoursiere. "Those FRP distribution poles, which didn't have any UV protection as we know it today, were taken out of service after 50 years. It wasn't for structural reasons, but because of fiber blooming—the fibers started protruding through the surface and aesthetically didn't look good," he notes. "Today, composite pole manufacturers incorporate multi-faceted UV protection in their products, and that's why we're confident of the 80-year life."

Power distribution poles range

Photo courtesy of Duratel

in length from about 35- to 50-feet and are produced in sections or as a single piece in various strength classifications. Transmission line poles are stronger and longer, up to 130 feet. Duratel, which launched its pole in 2008, offers one-piece products ranging from 35- to 75-feet in 11, 12 and 14-inch diameters. Plans are to extend the product line to as long as 110 feet. The poles, which are pultruded for Duratel by Bedford Reinforced Plastics, come off the pultrusion line at about a foot per minute for the 12-inch diameter, notes Lacoursiere.

Duratel poles, produced using polyester resin and E-glass, weigh about two-thirds less than wood. A 40-foot Duratel pole weighs 300 pounds. vs. about 1,000 pounds for wood. The Duratel products feature UV inhibitors throughout the resin and a protective veil cloth on the surface. The company sees its 14-inch diameter pole as its entrance into the transmission market.

Easier to Install

Lacoursiere observes that composite poles and crossarms appeal to utilities because of their reduced weight, making them easier to handle and install than heavy wood poles. FRP poles often are specified for installations in areas with limited access, which prevent the use of heavy equipment. FRP poles are especially useful for rugged terrain, where helicopters are commonly required to set wood poles. Lightweight FRP poles are often the only solution in confined urban areas, as well, he says.

The non-conductive nature of composites is another plus for FRP utility poles. "There has been extensive electrical testing done and, compared to wood, steel or concrete, composites are much safer for the utility crews and the public," adds Lacoursiere. "FRP poles also don't rust, unlike like steel poles; they aren't treated with environmentally unfriendly preservatives; and they are maintenance free."

Scott Holmes, UCSWG vice chairman, and president & CEO of Utility Composites Solutions (UCSI), relates that about 6 million poles are used annually in the U.S. for replacement and new grid growth. He asks: "Are composite pole manufacturers looking for 10 percent of that market? No. It's a very small niche and we are happy to work with utilities for special applications such as difficult-to-reach sites and woodpecker and insect-infestation areas. It's still a big market opportunity," he says.

"Adopting new technology is a barrier for utilities," continues Holmes. "First cost is their primary consideration in most cases. But if they were to look at things purely from a life-cycle basis, they'd be buying a lot more composite poles," he maintains. "Composite materials that we have to choose from today are more robust and have a better chemical makeup and composition because they've had the benefit of 30 to 40 years of improvements."

USCI recently ramped up production of its Intelli-pole for distribution applications. The poles, modular in design and tapered, are produced in sections by filament winding, using E-CR glass and a green vinyl ester resin formulation. "With a modular system, people are not handling 40- or 45-feet long pieces; they're handling 10- or 12-feet long pieces," says Holmes. "From the utilities' standpoint, the ease of handling is a big plus."

He notes that four sections are stacked to produce a 45-feet pole. The base section weighs about 250 pounds and the upper section weighs about 125 pounds, enabling a crew to carry them into an installation site by hand, notes Holmes. The modularity enables customers to keep various components in inventory and build up poles as needed. If a pole is damaged in an impact, the damaged section can be replaced while the upper sections of the pole remain intact.

Consider Installed Cost

"We're about three to four times higher in pricing than wood. But that's on the acquisition side," says Holmes. "An installed-cost comparison is where the benefits to utilities can be measured," he continues. "Utilities need to consider what it costs to bring in a helicopter or heavy equipment and the time involved to crane a pole into place versus how much less it costs to do it with a small crew by hand. Having portability with modular poles is an advantage."

Another manufacturer of modular utility poles is RS Technologies, which won the *Most Creative Application* ACE Award at the 2005 ACMA COMPOSITES show for its RStandard pole. The company has been producing the product line for about six years, using a proprietary polyurethane resin to filament-wind subsets of ten different modules. They are assembled to make poles up to 175-feet long and can be nested inside each other to save transportation costs and storage space. The RStandard pole is rated for up to a mid-range transmission application, notes Howard Elliott, chief operations officer.

"Composites are actually the low-cost option in utility poles, considering all the factors—the installation cost, the maintenance, certainly the reliability, the risk in keeping the grid up and running during ice and wind storms. We've had a lot of projects that were cost competitive right off the bat because of high installation and transportation costs of conventional poles."

An added benefit of a modular pole is the ability to add a section to convert it for tandem-use situations with a communications company, for example. But the primary advantage of composites over other types of poles is the ability to withstand storm-force winds and heavy ice loading. Elliott tells of an ice storm in January 2009 that took down more than 1,600 wood utility poles in Kentucky, while the RStandard composite poles that were installed as a pilot line on the grid remained undamaged.

"Utilities can use composite poles to harden the grid. They might install a composite pole every fifth one or so to stop those cascading failures that commonly occur with wood poles whenever a tree falls across a line or ice builds up," he explains. "The composite pole, which can handle the additional load, stops that cascade."

RS Technologies has invited many utility companies into its production facility to audit its manufacturing and

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Photo courtesy of Ameron International

Linemen working on a composite utility pole appreciate the non-conductive nature of composites as well as the lack of chemical preservatives.

quality-related processes. "Utilities are looking to answer the questions: 'Can you make the product the same way every time, and do you have a quality system that ensures that it will hold up and meet our specifications,'" says Elliott. "They watch us build product and observe our quality systems—we're ISO 9001 certified and have a very conservative quality program.

"We demonstrate strength by bending a pole 45 or 50 degrees without failing. Utilities are generally surprised and impressed. There aren't many materials that can handle that type of a deformation and come back to where they started without noticeable fatigue," adds Elliott.

Also in the Market

Other composites manufacturers produce utility poles, crossarms, polymer insulators and other products that offer a better alternative to traditional materials. Ameron International produces the sand-hardened uPole for distribution applications. Epoxy resin is used in a novel patent-pending process that adds layers of fine sand during the filament-winding of the poles, according to Product Manager Jim Davidson. Sand is also added to the final surface, before the pole goes through clam-shell heaters and is cut off in required lengths. "The sand bulks up the wall thickness and adds structural stiffness," he explains. Ameron can produce a 40-foot pole in 45 minutes. "Our price is roughly double that of wood and very competitive with steel," he notes.

Shakespeare Composite Structures is an early pioneer in FRP pole production, having started 20 years ago, and was the first to manufacture large poles (longest today is 130 feet.) The poles are filament-wound using polyester resins and a pigmented polyurethane topcoat for UV protection. "In the longer sizes, we become not only product competitive but price competitive with the other materials, relates Bill Griffin, vice president and general manager. "It's hard to find trees in transmission lengths and difficult to move them around," he says. The largest single length produced by Shakespeare is 50 feet. Longer poles are assembled from sections with overlapping joints.

Other leading players in this market include Composite Materials Technology, which produces tapered distribution poles using E-glass and polyester resin in a centrifugal casting process. Each pole starts with layer of polyester veil, on which a knitted fiberglass fabric is laid. Other reinforcements are added, and the pattern is inserted into a spin-casting machine. Resin is introduced as the machine spins, wetting out the reinforcements.

FRP Transmission Innovations (TI) has introduced C-channel shaped composite profiles for use as crossarms and braces for H-frame structures. Pultruded by TI's strategic alliance partner, Creative Pultrusion, the products replace heavy wood timbers and steel beams. Two C-channels are joined back-to-back on either side of a pole to form a crossarm assembly. Grant Lockhart, managing director, notes that the products are comparable in price to wood and less expensive than steel. Creative Pultrusions also

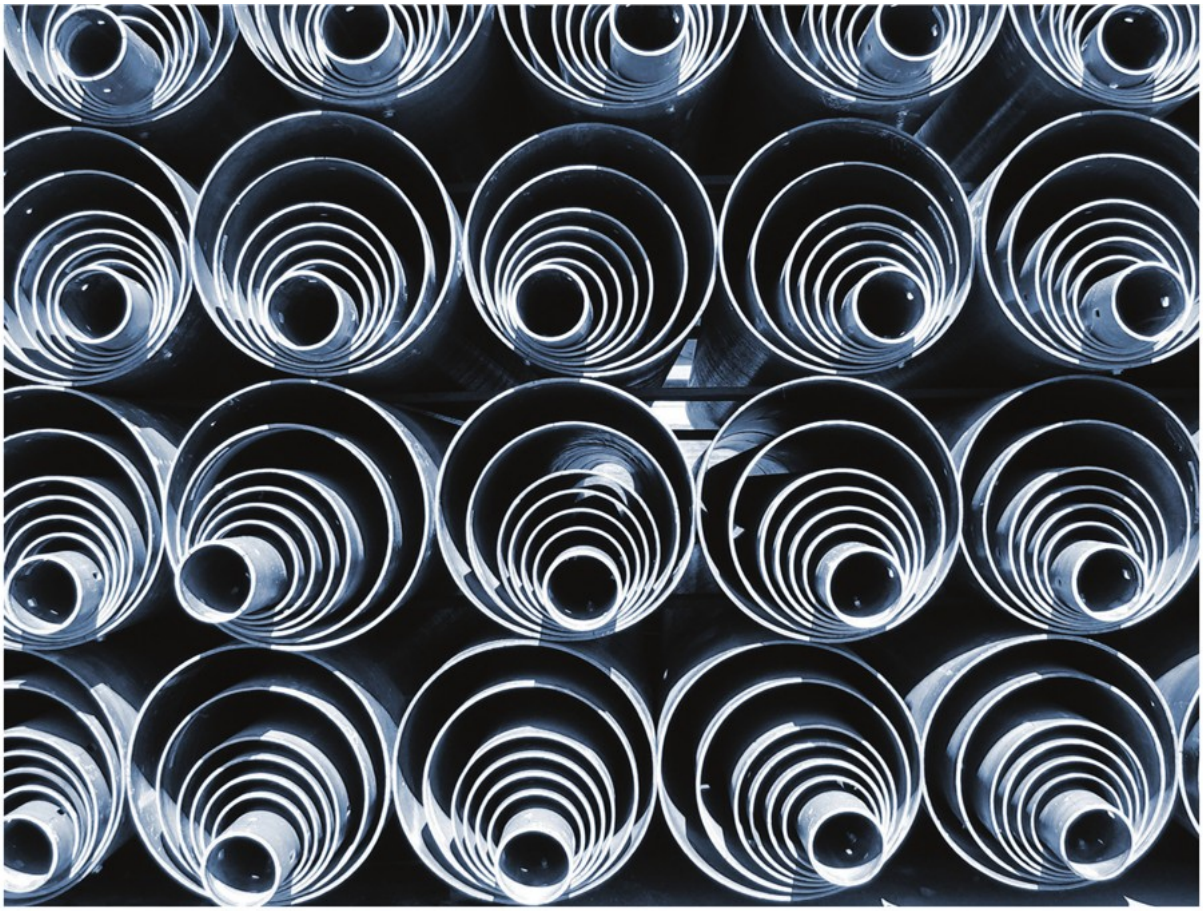

Photo courtesy of RS Technologies

Composite pole sections are nested inside each other to save space during storage and transportation.

produces Powertrusion 8-inch and 10-inch distribution poles and crossarms, working with more than 25 utility companies.

Geotek produces composite crossarms under the brand name PUPI, which was launched in 1990. Pultruded PUPI crossarms, deadend assemblies and braces are used by electrical utilities around the world, according to Dean Casad, vice president of sales and marketing for Geotek, Stewartville, Minn. Three levels of weathering protection are used for the lightweight, high-strength products. Casad feels that the biggest roadblock to the widespread use of composites in utility applications is previous experience with inferior fiberglass products that may have been negative, often due to blooming.

Glasforms is a leading global supplier of pultruded composite rods for guy strain insulators and similar products that are lighter and more durable than conventional porcelain and glass insulators, reports Peter Pfaff, who heads the company. A key advantage of the FRP products is their superior ballistic resistance, he says, noting that more than a million porcelain and glass insulators are destroyed every year in the U.S. by people taking pot shots at them. The FRP versions do not fail catastrophically. About 75 percent of the insulators in use today incorporate FRP rods, notes Pfaff.

Our goal is to have these poles become a standard option alongside wood poles and structures. Composites can solve a lot of problems for utility companies that traditional materials don't handle very well.

Says Elliott of RS Technologies: "The adoption of composites is still in its early stages in the utility industry—less than one percent. Our goal is to have these poles become a standard option alongside wood poles and structures. Because of their light weight, long life, high strength, non-conductivity and environmentally benign nature, composites can solve a lot of problems for utility companies that traditional materials don't handle very well. We believe that once the utilities crunch the numbers, they will start moving composites into more and more standard installations."

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