Steel Monopoles Leave Light Footprint on the Environment

The need for a new line was clear. A large portion of northwestern Wisconsin's transmission grid was built to meet the electricity needs of the 1940s and 1950s. By the late 1990s, the state's demand for electricity was growing 2% - 3% each year. The existing line could not reliably accommodate this kind of growth and threatened, under certain load conditions, to cause blackouts across large, populated areas. The solution: Improve the reliability of the grid by building a new 345kV line, 220 miles long from Wausau, Wisconsin to Duluth, Minnesota – the area's most challenging infrastructure project in decades.

Additional challenges reached far beyond engineering and construction concerns. Aggressive anti-line groups fought against the project. Land owners and environmentalists formed a unified front to complicate right-of-way issues for the line, which would cross over 80 miles of wetlands. Protecting the environment quickly became a top priority, especially at the scenic Namekgon River crossing. Public and government groups demanded an almost unseen structure in this area, which created extreme design obstacles to balance the aesthetics with the physics of the loads and materials involved.

A key factor in resolving many of the environmental and aesthetic concerns was the decision to use weathering, tubular-steel monopoles, supplied by Trinity Meyer Utility Structures. The flexibility, reliability and strength of steel structures provided the design team with the most efficient solutions for resolving the special design needs of the crossing's monumental 1,500-foot span, for building across difficult terrain along the line's path, and for satisfying tough public demands. Leaving a smaller footprint on the environment than the existing H-frame wood poles, most of the structures were single-shaft poles with drilled pier foundations, essential for the narrower rights-of-way in both states.

Steel structures also allowed designers to customize special configurations, which included single-circuit, single-shaft structures; double-circuit, single-shaft structures with four different voltage levels; double-circuit, single-shaft structures with 46kV underbuild; and two-pole, heavy angle deadend structures.

This flexibility of customization played a vital role in meeting the Public Service Commission of Wisconsin's requirement to share corridors with as many existing utility easements as possible and made it possible to replace portions of 12 existing lines, owned by four different utilities, with double-circuit lines.

To add to the complexity of this project, the system was designed to survive a 400-year return period weather event. This meant using two distinct loading criteria – one to handle the weather effects of north central Wisconsin and another to accommodate severe icing conditions near Lake Superior, which can cause nearly two inches of radial ice loads. In both cases, the system was designed for winds over 100 mph.

Accomplishing such extreme environmental and design challenges required more than 50 million pounds of steel and nearly 1,600 steel structures, some weighing in at more than 100,000 pounds each and reaching 180 feet in height, designed to carry thousands of miles of cable across the vast transmission line.

The success of this complex project required the decades of experience, creativity, dependability and "Let's make it happen" attitude of the Trinity Meyer Steel Structures team, who worked hand-in-hand with construction teams to ensure structures were delivered when and where they were needed to seamlessly synchronize with the installation timeline. The dedicated collaboration of all involved enabled the project to be completed seven months ahead of schedule. Energized in January 2008, the Arrowhead-Weston line carries enough electricity to power 250,000 homes and provides a significant upgrade to the reliability of regional grid.