THE GRID

A PUBLICATION OF FINLEY ENGINEERING • MAY 2008

## WELCOME TO THE GRID

By Phillip Carroll, Vice President of the Power Group for Finley Engineering

Welcome to The Grid, our quarterly newsletter highlighting the power industry's trends. For more than 50 years, Finley Engineering Company has taken pride in being a leader in the design, engineering and construction of electrical power systems. We understand the challenges of today's industry environment. With more than 200 employees in nine offices working for your business, we are experienced in helping our clients ensure future success.

This issue our theme is ice storms and how they affect power lines – what to do before, during and after the storm; why some lines fall and some don't; and how to design lines to protect them against future damage.

Enjoy the issue.

# ICE STORMS TEST MIDWEST

**December storms knocked power out in five states and 145 counties; Finley assists in mitigation efforts.**

In December 2007 severe ice storms struck parts of the Midwest, leaving hundreds of thousands of people without power for up to 10 days after the storms. Some areas reported ice buildup of over 2.5 inches on power lines, causing lines and poles to snap under the added weight.

Finley Engineering vice president of the Power Group, Phillip Carroll, P.E., says that during the height of the storm there were widespread blackouts in those areas most heavily damaged. The Federal Emergency Management Agency (FEMA) declared disaster areas in 145 counties in Iowa, Kansas, Missouri, Nebraska and Oklahoma with damage estimates exceeding $219 million.

The storms have now passed, and the electricity is back on, thanks to round the clock efforts of line crews brought in from around the Midwest. But, the problems aren't necessarily fixed. A lot of the initial efforts were geared towards getting the power lines functional as quickly and safely as possible so people would have heated shelter from the extreme winter conditions.

The storm damage has alerted key electrical staff members to plan for ongoing efforts to improve pole and line strength. FEMA has released funds for mitigation efforts to help improve the strength and reliability of the power lines. This will help ensure if there is another ice storm, or other severe weather event, these areas will not be affected in the same manner as the December 2007 ice storm.

(continued on next page)

## NAVIGATING FEMA

Qualifying for FEMA funds can be a daunting, but necessary, task for electrical utilities that need money to rebuild after a disaster. Finley Engineering is equipped with licensed engineers to assist with applications for mitigation funds to improve those damaged utilities.

"It is beneficial for utilities to contact an engineering firm to perform the actual damage assessments because FEMA recommends third party verification," says Frank Brown, RUS Project Manager for Finley. "We are readily available to help any company navigate through the application process."

Following are some of the steps to take in order to successfully complete the process to qualify for FEMA financial assistance after the disaster area has been declared.

- The State Emergency Management Agency (SEMA) requires each electric utility have all projects reviewed by a licensed engineer to determine if lines should be replaced due to public safety issues or to help mitigate the same type of disaster causing the same destruction again.
- SEMA will meet with impacted companies to write a disaster damage assessment that includes the estimated cost to rebuild.
- If the project receives approval, the engineer designs new power lines for each project and construction can begin.
- The utility has 18 months (with a possibility of an extension) to complete approved projects using FEMA funds. FEMA retains the right to audit the company for up to two years after construction is complete.

"Mitigation funds are available to all electric utilities in the states with disaster declarations," Brown says. "The purpose of those funds is to reduce the long-term costs of those disasters, and cooperatives needing to upgrade their facilities are encouraged to apply for funds."


(continued from previous page)

**Rebuilding after the storm.** Designing for an appropriate loading level to mitigate damage during these extreme weather events requires knowledge of the statistical nature of the event. For example, the December ice storm had an estimated 200-year return period.

"A common reaction to damages from a severe storm is to replace or restore the equipment to a design level that can withstand the loading levels produced by the storm that caused the damages," Carroll says. "However, most power delivery systems are designed to withstand weather events with return periods of 50 years."

Designing and maintaining lines that would last through all climatic events is cost prohibitive. Instead, Finley recommends that designers look at the 50 year weather patterns and design around the patterns that repeat most often.

And, public education also plays a big role in keeping power lines up. A good tree trimming program is necessary to keep tree limbs and branches away from wires and will pay a large dividend during storms.

"Our mission at Finley is to provide sound design and construction standards for each electrical utility. Economics, longevity, overall strength and reliability are all considerations that must be evaluated when designing power lines," Carroll says.

There are three basic steps that can improve the performance of the lines.

**1. Shorten the wire spans between poles.** Wire span lengths used to be stretched to the maximum length, and the poles installed were a smaller class. The net result is the poles and wires do not fare well due to the weight of the ice.

**2. Upgrading to a heavier class of hardware for both the poles and cross arms.**

**3. Guying for heavier loads.** If one of the guys fails, you'll see a cascading failure of lines where several poles fall because the guys failed.

# FINLEY DESIGNS TRIPLE CIRCUIT REQUIRED FOR BIODIESEL PLANT

Biodiesel plants are becoming a more frequent sight in the rural Midwest due to increasing demands for alternative fuels. Recently, a plant opened in Vernon County, Missouri, and due to the unique electrical needs, Barton County Electric asked Finley Engineering to manage the design and installation.

It became apparent that a transmission line and substation could not be sited in time to meet the plant start date. The challenge then was to find a way to supply the biodiesel facility's 7.7 MW energy load through the distribution system from a source 12.5 miles away.

Because of the large load requirement, Finley designed a triple circuit 25 kV and 13 kV 3-phase aerial distribution line. Two lines were dedicated to the plant's electricity needs, with the third dedicated to existing loads already in the region. A fiber optic communication link was also required.

The lines were held up with 45 ft. class 2 poles, which are significantly larger than the average distribution pole, to support the much heavier and larger lines. Shortened wire spans and larger poles are necessary to ensure avoidance of power outages due to unfavorable weather conditions, such as ice and/or high winds.

Normally, a project of this magnitude would take approximately 8-12 months to complete. But, due to a tight completion deadline, Finley was given only six months. The project, estimated at $2.2 million, was sent out for competitive bids in August 2007, with construction slated to begin in September.

The project was on track for completion by the Dec. 31, 2007 deadline. Unfortunately work had to be halted during the December ice storms, and the project was completed Feb. 1, 2008.

"This project was given an extremely tight timeline," says Frank Brown, RUS Project Manager for Finley. "Thanks to the well coordinated effort of the suppliers, contractor, owner and engineer the project was a success. If it hadn't been for the severe weather, we would have hit the target date."

## Q&A

The National Electric Safety Code (NESC) presented here are not intended to be formal interpretations.

**Q I am confused about the wire line clearance requirements over roads, drives, etc. What clearance values should I use?**

A This can be confusing, as the method used per NESC has changed over time.

The 1987 ed. and older versions evaluated clearances above ground, roadway, rail or water surfaces based on a 175 ft. span for heavy district and conductor temperature at 60º F, no wind displacement, final unloaded sag. The clearance over a roadway for a 7.2 kV L-G primary under these conditions would be 20 ft.

In the 1990 ed., the criteria changed to whichever produced the largest final sag:

- 120º F, no wind displacement
- Maximum conductor temperature for which line is designed to operate if greater than 120º F, with no wind displacement
- 32º F, no wind displacement, radial thickness of ice for specified loading district

For heavy district over a roadway for a 7.2 kV L-G primary, the clearance is 18.5 ft. For final determination some field measurements and an engineering determination are required.

When evaluating compliance, technically the code in effect at the time of initial construction would be used, however, it is prudent risk management to consider present code requirements.

If modifications are made to poles and facilities, current requirements must be met. In some instances of a combination of span length and conductor conditions, you may find it necessary to install a taller pole to meet code.