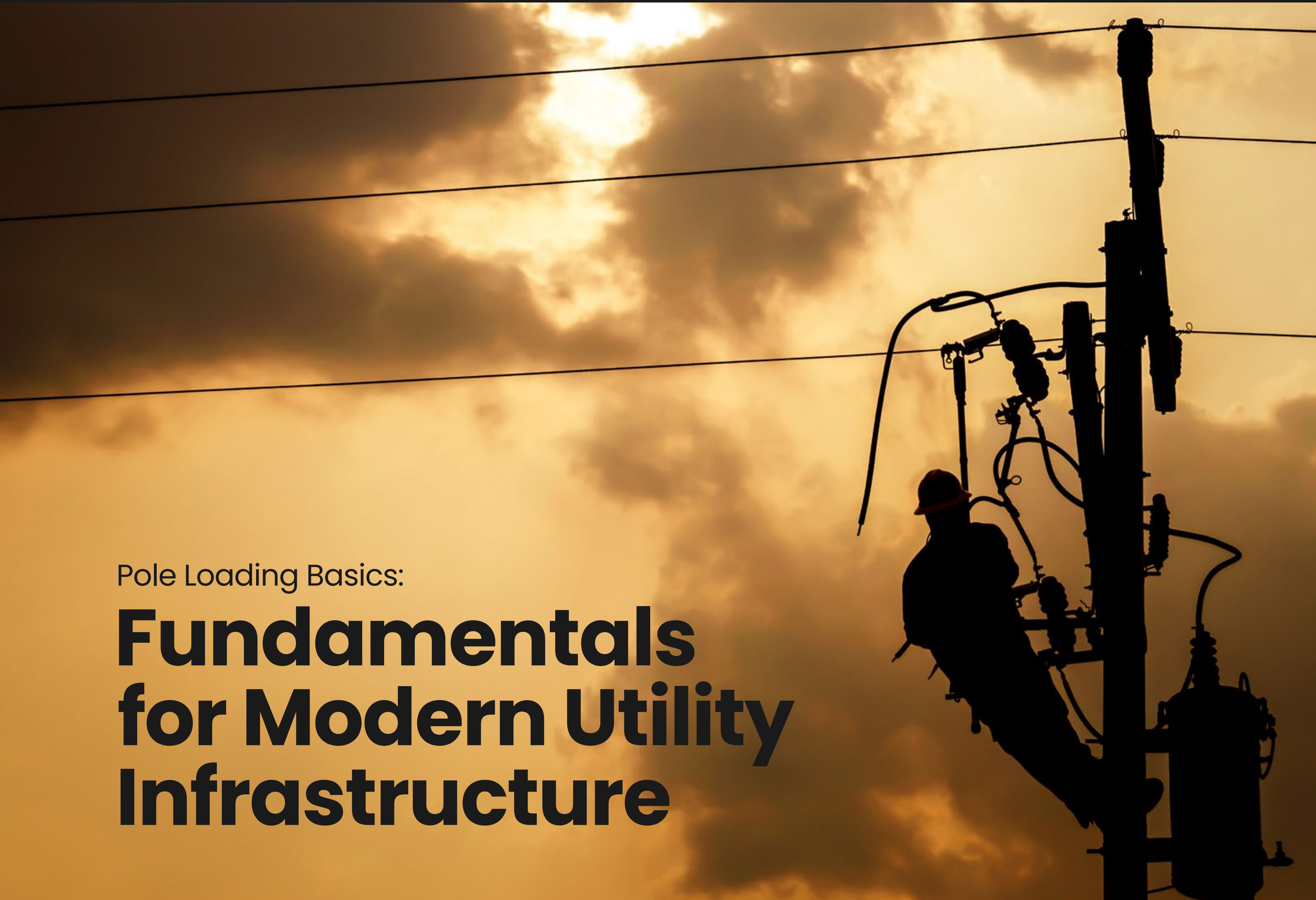

Pole Loading Basics:

Fundamentals for Modern Utility Infrastructure

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Pole Loading Basics: Fundamentals for Modern Utility Infrastructure

Pole loading is a critical process in the design and construction of utility infrastructure. Understanding, analyzing, and accounting for the forces that affect utility poles—such as equipment weight; the size, strength, and material of the pole; and environmental conditions—prevents overloading, which can otherwise lead to failure. Implementing proactive strategies for asset health and modern pole loading practices helps ensure safe and stable utility poles that comply with regulations and guidelines for a reliable network, as well as are fully capable of supporting overhead utilities. These strategies allow utilities to achieve their ultimate goal—maintaining infrastructure and keeping employees and the public safe.

What Is Pole Loading?

Pole loading is the process that engineers and designers use to evaluate the forces acting on a utility pole under a specific set of conditions. This evaluation includes the size and strength of the pole and the weight of equipment, such as transformers, attachments, and guy wires.

In addition, assessing overhead infrastructure under specific weather patterns and geographic conditions enables engineers to ensure that proper safety margins are maintained. Evaluating existing and proposed pole conditions determines if the pole is strong enough to withstand all the natural forces that it will be subjected to, such as wind, ice, snow, and temperature.

Industry Drivers

Pole loading analysis is especially important for adapting to climate change and industry drivers such as:

- Increased demand for electricity
- Unprecedented storms
- Aging infrastructure that affects strength and condition
- Increased need for a communication infrastructure that supports the latest advances in technology
- Grid modernization and resiliency measures

3 Types of External Loads

To ensure structural integrity and reliability, it is important to understand the various types of external loads acting on utility poles. There are three primary types of loads: transverse, vertical, and longitudinal. Each type represents specific forces that impact poles differently, such as wind, wire tensions, equipment weight, ice on conductors, and wire tension along the line.

1. **Transverse:** The force perpendicular to the direction of the run caused by wind and wire tensions
2. **Vertical:** The force in line with the axis of the pole caused by equipment, conductors with ice, guying
3. **Longitudinal Wire:** The force parallel to the direction or run of the line caused by dependent wire tension

Pole Loading: Ensuring Safety and Stability

Pole loading is important for one major reason: safety. If a pole is overloaded, it can fail, causing power outages, vehicle and property damage, and even serious injury or death. It can also result in an angry public or even lawsuits.

Among the hundreds of millions of poles that span miles across the country, it is possible to identify at-risk edge cases—ones most likely to fail before planned replacement—by performing pole loading analysis.

This assessment helps to determine if the pole can withstand the external loads that it encounters in its environment without failure or compromising safety.

Underbuilding and Overbuilding

Underbuilding is an additional factor that can cause significant pole loading issues. Underbuilt pole lines can affect regulatory compliance, safety and potential liability, and system reliability. Conversely, overbuilt pole lines contribute to increases in short- and long-term costs, and operational requirements. An additional anchor during the design process can increase the project cost. Furthermore, requirements for additional assets in the design not only increase the single project cost, but also increase operational costs over the lifetime of the asset.

Key Factors in Pole Loading Analysis

During the analysis, engineers consider several key factors that can cause utility pole issues. Some of these include:

- **Equipment and Attachments:** The type, weight, and placement of equipment or attachments on the pole significantly affect loading. Transformers, cables, antennas, and other hardware can add significant weight and stress to the pole.
- **Environmental Conditions:** Different regions experience varying weather conditions. Environmental factors—such as wind speed, weather patterns, temperature variation, and even soil conditions—can affect the pole's stability.
- **Pole Design and Materials:** The pole's design, materials, and construction determine its load-bearing capacity. Factors—such as the pole height, setting depth, material strength (wood, steel, concrete, etc.), and structural design—influence how much load the pole can safely bear.
- **Types and Numbers of Guying:** Guy wires play a crucial role in distributing the load and stabilizing the pole, especially to support taller or more heavily loaded poles.
- **Age of the Pole:** As a utility pole ages, its structure can have impactful changes on safety and resiliency if it goes unchecked. Natural causes, such as rot (heart/shell), and unnatural causes, such as woodpecker holes, can prematurely impact the life of a pole.

Key Benefits of Optimizing Pole Loading Workflows

Improving a utility's pole loading practices extends far beyond fortifying the safety and stability of the grid. Significant benefits range from financial liability to the integrity of the electrical grid that could affect widespread areas and disrupt the power supply for extended periods of time.

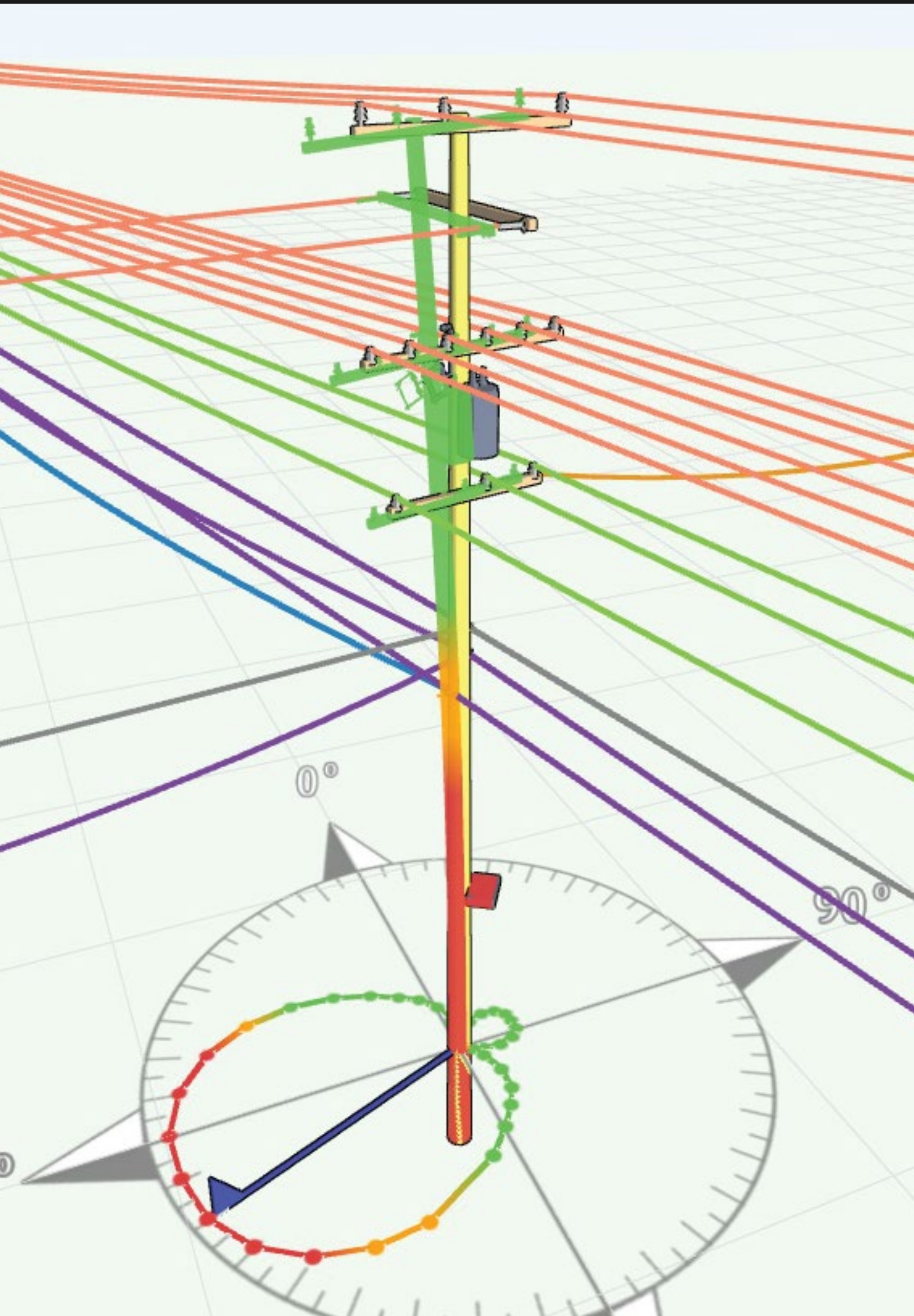
Reduce Financial Liability
By proactively identifying and addressing overloaded poles, utilities can avoid the costly consequences of outages and accidents. This process includes minimizing the risk of property damage or fines for non-compliance with safety regulations.

Improve Operation Costs
Insights into spending associated with pole loading and design can lead to proper forecasting and optimizations of work efforts.

Ensure Reliability
By preventing overloading and ensuring the structural integrity of poles, accurate pole loading practices help maintain a reliable and stable power supply. The frequency or duration of outages and other risks is greatly reduced.

Secure Grid Integrity
The integrity of the electrical grid is critical. By ensuring that poles are not overloaded, utilities can prevent cascading failures that affect large areas. These failures can disrupt the power supply for extended periods while compromising the safety and security of the network.

Verify System Resiliency
Pole loading analysis helps utilities identify vulnerabilities in the infrastructure that require investments in modernizing the grid. These investments create a more resilient system that can withstand extreme weather events or other disruptions, reducing the likelihood of outages.



Adopting Pole Loading Best Practices

Understanding the fundamentals of pole loading is just the first step. Incorporating better pole loading practices into utility operations is a multifaceted process that requires careful planning and execution.

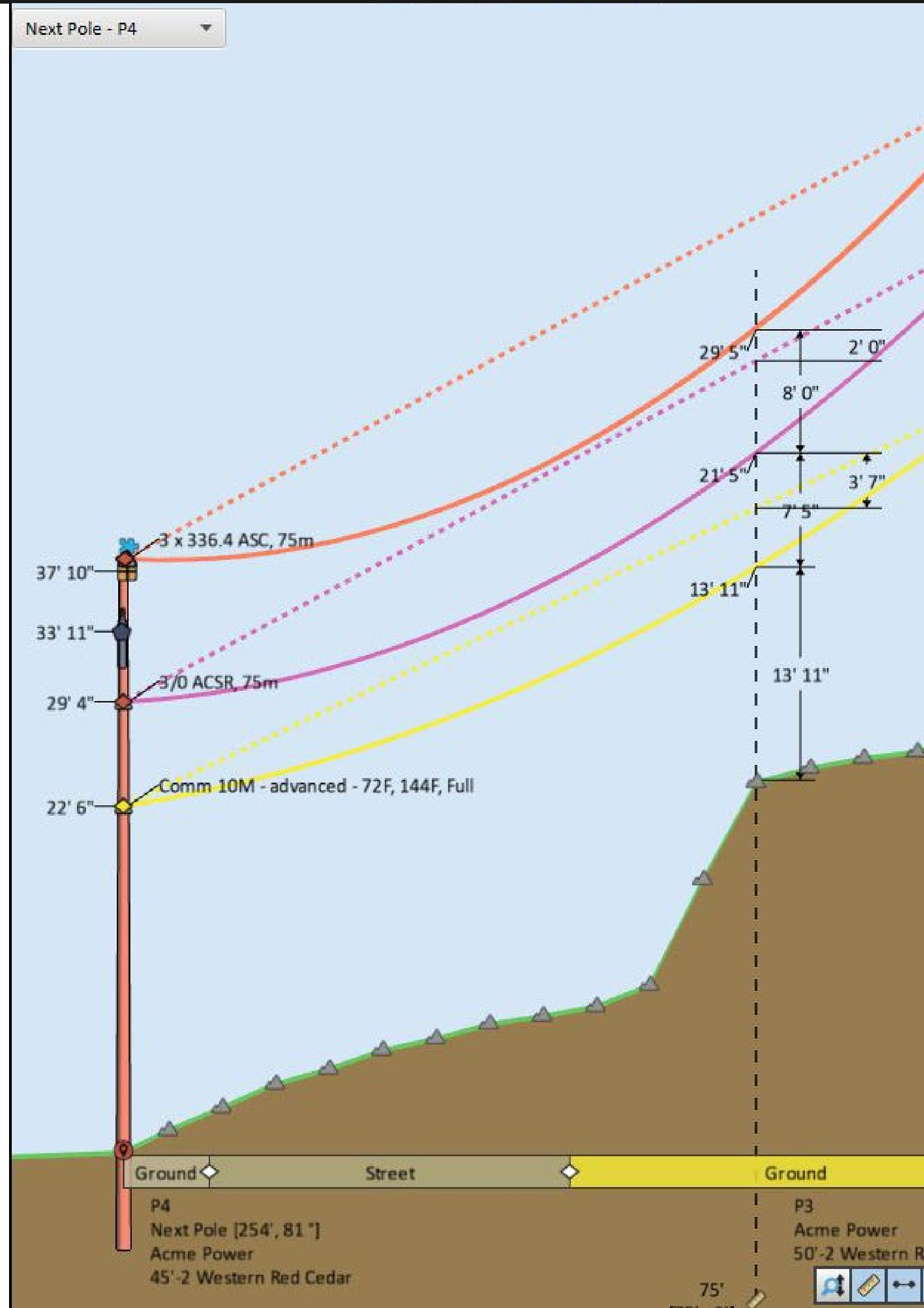
Here are some important ways to improve pole loading practices:

- **Set Standards:** In addition to safety codes, utilities should set standards, policies, and practices within their daily operations.
- **Know the Limitations:** Understand the limitations of the policies and standard practices that you need to follow to maintain regulations.
- **Start Small, Then Scale:** Eliminate complexity by starting to implement small, simple changes, expanding as processes are better defined.
- **Use Efficient Methods or Software:** Find a pole loading method or software that best fits the needs of your organization
- **Work with Experts:** Develop in-house subject matter experts or find a partner you trust.

Adopting Pole Loading Best Practices (continued)

- **Be Proactive:** Gain an understanding of how to recognize and resolve issues if and as they arise.
- **Pick One Use Case to Start:** Use an upcoming line conversion or river crossing project to gain a better understanding of the results and include a detailed record of any new findings, such as time savings.
- **Regular Pole Inspections:** Conducting regular assessments of existing poles is a critical part of identifying assets that are no longer safe due to decay, mechanical damage, or climate factors.

Being proactive in identifying and resolving potential issues as they arise fosters a proactive culture. Adopting pole loading best practices can help you maintain the safety and reliability of utility poles while preventing critical disruptions to operations.

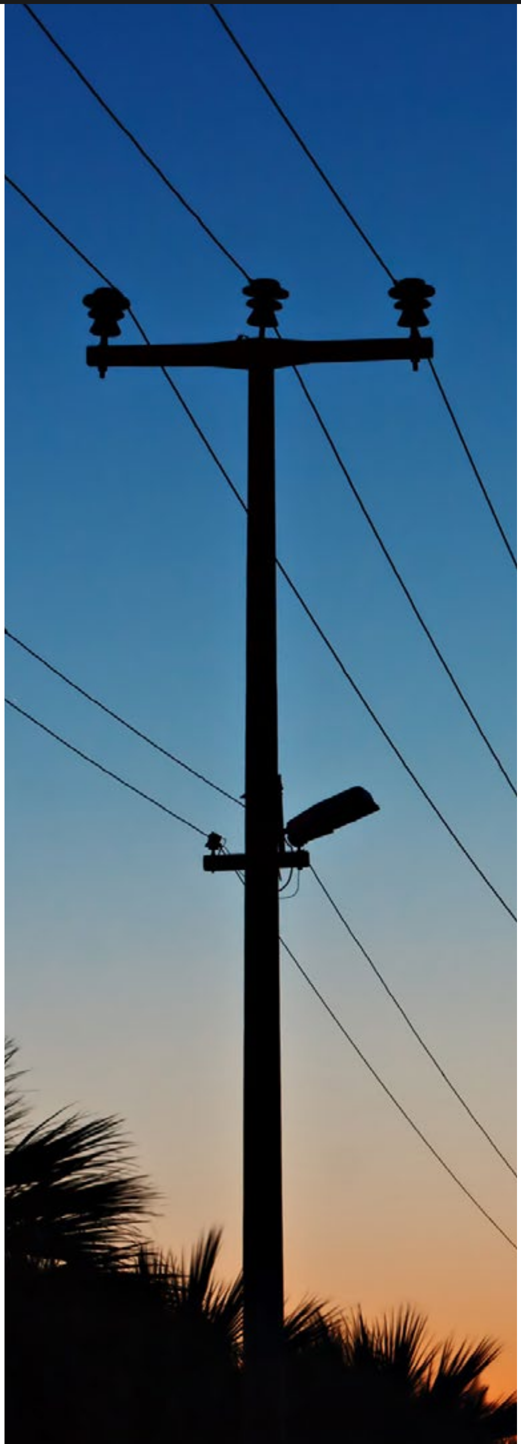


The SPIDA Solution for Efficient Asset Health

There is a better way to manage your overhead infrastructure. Instead of reacting to each crisis as it happens, SPIDA provides a path forward so that you can build long-term proactive strategies to achieve efficient asset health.

What Is SPIDAcalc?

SPIDAcalc is structural analysis software designed for utilities, contractors, and telecommunications companies. Traditional methods of pole loading are manual, tedious, and time-consuming. SPIDAcalc enables engineers and designers to automate the entire process. This software uniquely pairs with pole design and reliability analysis by creating a digital twin of existing utility overhead systems. It eases the process of modeling, analyzing, and optimizing overhead design assets.



SPIDA SOFTWARE
Part of Bentley Systems

SPIDAcalc offers a range of capabilities that streamline your workflow, reduce repetitive or time-consuming tasks, and elevate your design outcomes. Some of these benefits include:

- Superior user interface
- Analysis engine
- Wire sag and tension
- Design comparison
- Automated clearances
- Cloud-based analysis
- Line connectivity
- Communications bundles
- Terrain modeling

Learn More about SPIDAcalc

Understanding the fundamentals of pole loading, new standards and requirements, and how you can modernize your infrastructure is fundamental for today's modern utility. Implementing a product like SPIDAcalc can help you collect, model, and optimize overhead assets, giving you transparency, control, and flexibility while improving your system's integrity and reliability, reducing safety concerns, and optimizing your financial investments.

See SPIDAcalc in Action

Request a Demo