Electric Transmission Corridor Mapping

Using LiDAR and Imagery for Meeting FERC Regulatory and NERC Requirements

In order to meet the multifaceted challenge of providing a safe, reliable energy supply servicing markets with constantly growing demands, it is critical for utility companies to maintain existing infrastructure today while looking ahead and planning for new power line corridors to meet future growth. This requires accurate and timely surveys of current infrastructure and assets as well as surveys for deployment of future infrastructure.

LiDAR (Light Detection and Ranging) is technology developed for creating highly accurate, three-dimensional surveys of terrain, vegetation and electric utility infrastructure.

Close-range LiDAR is classified as having the sensor positioned at distances ranging from 500’ to 1,500’ from the features to be acquired. The acquisition for modeling can be accomplished from the air or ground.

Close-range aerial LiDAR is typically collected from a helicopter platform and can yield x,y,z point densities of 25 to 40 per square meter. Static terrestrial scanners and kinematic mobile mapping systems collect the LiDAR and image data from ground perspectives at densities ranging from 500 to 2000 points per square meter.

These LiDAR collection technologies can be deployed independently, or in tandem for effective electric transmission corridor mapping.
3D Modeling & Engineering Analysis
Sanborn utilizes the latest data acquisition technology for modeling overhead lines, structures, terrain and vegetation features.

The features will be extracted from the point clouds so electric engineers can model and calculate line ratings, element sag and tension using the surveyed conductor positions. Three-dimensional engineering models will be constructed from actual field “as built” surveys that precisely map the relationship between all of the natural and manmade utility ROW features. In addition, various weather combinations including wind, barometric pressure and temperature will be captured during the mission to support the building of PLS-CADD™ Method 1 models for analysis including:

- Stringing and graphically sagging the wire to match the surveyed wire points at its rated temperature.
- Survey Point Clearance reports for each circuit or line segment.
- Perform engineering analysis and calculations including:
  - Maximum operating temperature for each circuit.
  - Circuit summary on a span-by-span basis
  - Minimum clearance to terrain surface
  - Survey point clearance reports, wire blowout, insulator swings, maximum sag condition

LiDAR Operating Principles
LiDAR was developed as a fast and accurate method to gather digital elevation model (DEM) data. To collect LiDAR data, a laser is fired from an aerial or terrestrial GPS-located sensor and the pulse’s return time is measured to determine distance.

With hundreds of thousands of measurements collected each second, the data-rich multiple LiDAR returns are then used to produce a geospatially accurate survey of terrain, vegetation, surface features and structures for a specific area.

With multiple state-of-the-art aerial and terrestrial LiDAR sensors and thousands of square miles of data successfully acquired and processed, Sanborn sets the highest standards for accuracy and reliability in LiDAR data acquisition and processing.

GPS Satellite
Global Positioning System satellites transmit signals to receivers/equipment enabling mapping entities to determine with precise positional 3D accuracy the location for an asset or a feature on the earth’s surface.

Mobile LiDAR Scanner
The Sanborn Mobile Mapping survey solution collects engineering/survey grade LiDAR data over large areas with a system delivering better than 5cm accuracy and resolution of up to 1cm, offering unprecedented 3D detail from a vehicle moving at speeds up to 60mph.

Utilities Applications
Sanborn Mobile Mapping provides for the rapid 3D mapping of overhead wires, utility, and power infrastructure including substations and power transmission corridors.

Benefits
- Accurate / rapid survey of overhead lines and wires
- Complete inventory of connectors, transformers, poles, etc.
- Accurate and rapid identification of obstructions and encroachments within utilities rights-of-way
- Mapping as-built infrastructure for dams, power plants, etc.
Aerial LiDAR Scanner (Close-Range)

Close-range LiDAR is classified as having the sensor positioned at distances ranging from 500' to 1,500' from the features to be acquired. The acquisition for modeling can be accomplished from the air or ground. Close-range aerial LiDAR is typically collected from a helicopter platform and can yield x,y,z point densities of 25 to 40 per square meter.

Aerial GPS (Global Positioning System)
Based on GPS satellite triangulation, measures the location of the aircraft every 0.5 second.

Aerial IMU (Inertial Measurement Unit)
Measures attitude (pitch/yaw/roll) of aircraft every .002 second

Ground GPS
Measures the location of the aircraft every 0.5 sec. relative to a known ground position
NERC Compliance
The North America Reliability Corporation (NERC) released an industry alert stating “possible discrepancies between the design and the actual field conditions of transmission facilities as a potential reliability issue that needs prompt industry attention.” The alert recommends that entities review their current facilities rating methodology to verify that the methodology is based on actual field conditions, rather than solely on design documents, and take corrective action if necessary.

Asset Inventory for GIS and Facility Management
Sanborn can extract parts and other attributes from an existing company ODBC compliant database and link the tabular information to the mapping graphics for use in PLS-CADD or a GIS system. The database attributes are linked to the points and lines collected from the LiDAR to build a comprehensive inventory of structures and assets of the entire utility infrastructure. When merged with various state and local tax boundaries, a simple overlay analysis can determine the exact assets for each taxing jurisdiction so local tax records can be reconciled to save millions of dollars in annual tax expenses.

FAC-003 Vegetation Management Programs
LiDAR and Imagery provide data to support the Transmission Vegetation Management Program to reduce vegetation related outages due to encroachments and wind or “blow-out” dangers. In addition to standard vegetation clearance reports, Sanborn can incorporate sophisticated predictive analysis capabilities developed for the forestry and wildfire hazard modeling programs. This decision support system will provide a proactive means of managing vegetation within utility ROWs.

FAC-008 Facility Ratings
NERC promotes accurate measurements, including LiDAR, as a means to enhance the understanding of the technology, methods and techniques available to industry. Use of Close-Range LiDAR and high resolution orthophoto and oblique imagery provide actual as-built field conditions for evaluating facility ratings. The 3D modeling and analysis will identify the full extent of field discrepancies that could impact facility ratings. By doing so, utilities can prioritize corrective actions based on operational and reliability significance. The corrective action plan will enable the utility to systematically maintain the reliability of the bulk power system.

Route Mapping for Design and Expansion
Increased demand for electricity and an emphasis on alternate forms of “green” power generation have placed a demand on the existing grid that requires utilities to expand or redesign current generation, transmission and distribution capabilities. Sanborn can provide medium and long range LiDAR datasets from a fixed wing aircraft that enables engineers to tie into existing infrastructure, while capturing the proposed new route for design and construction. For critical design areas, terrestrial static or mobile mapping can provide the detail required for power generation facilities, sub-stations and distribution lines.

About Sanborn
Sanborn is a 21st century industry leader in geospatial solutions and technology, offering superior services, program management, and customer support. For our clients we provide a national presence, extensive resources, quick responses, and exceptional value. For over a century, we have been a leader in the rapidly growing geospatial industry, with successful projects delivered worldwide. For more information, visit us online at www.sanborn.com, or call 1.866.726.2676 to speak with a representative.