

Compliments of Aerial Services, Inc.

LiDAR and NERC Reliability Standard FAC-003-2

On 1 July 2014, the [NERC Reliability Standard FAC-003-2](#) went into effect. This transmission vegetation management regulation requires that overhead transmission lines (including some lines under 200 kV and all lines over 200 kV) need to be inspected at least once each year (and not more than 18 months between inspections). Some transmission lines may be designated with a higher frequency of inspection because of factors like anticipated growth rates

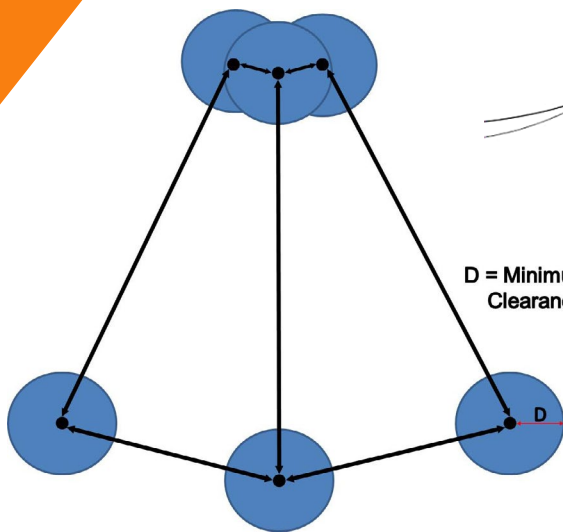
of the local vegetation, length of the local growing season, limited ROW width, and local rainfall. Further, failure to complete more than 15% of the transmission owner's annual vegetation work plan for its applicable transmission lines is classified as the highest type of violation ("severe").

The standard prescribes a "minimum vegetation clearance distance" (MVCD). This is the minimum distance needed to prevent flash-over to vegetation. Flash-over can lead to "cascading" where

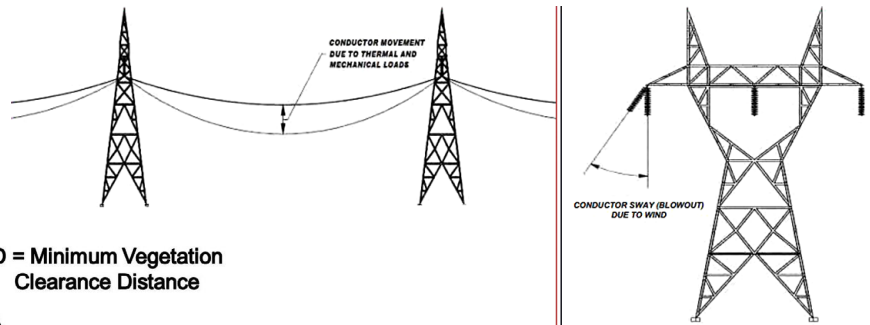
a failure in one part of the grid can spawn failure in successive parts. This is an important safety variable for each line because the conductor's position in space is continuously changing in reaction to a number of different thermal and physical loading variables.

"Thermal loading" is a function of line current and the combination of numerous variables influencing ambient heat dissipation including wind velocity/direction, ambient air temperature and precipitation. "Physical loading" applied

BY MIKE TULLY



D = Minimum Vegetation Clearance Distance



Above: Conductor movement due to thermal and mechanical loads.

Left: Cross-section view of a single conductor showing six possible positions and the Minimum Vegetation Clearance Distance (MVCD) due to movement resulting from thermal and mechanical loading.

to the conductor affects sag and sway by combining physical factors such as ice and wind loading. The MVCD should never be violated and can range from less than 1 foot to more than 11 feet depending on system voltage and altitude. They may be maintained at greater distances for safety reasons.

line failures when lines are experiencing large sags. The thought is that keeping vegetation from entering this space will prevent transmission outages.

FAC-003-2 stipulates that all transmission lines subject to this regulation are to be inspected annually and that 100% of the vegetation work plan must

demonstrating that aerial LiDAR and imagery surveys provide an information rich and detailed basemap of ROWs. Many transmission owners have used LiDAR to support their management needs as required by FAC-008 that addressed facility ratings. These required considerable LiDAR point densities and considerable mapping labor. On the other hand, LiDAR surveys needed for vegetation management to support compliance with these mandated annual corridor inspections per FAC-003 require much less point densities and are more economical.

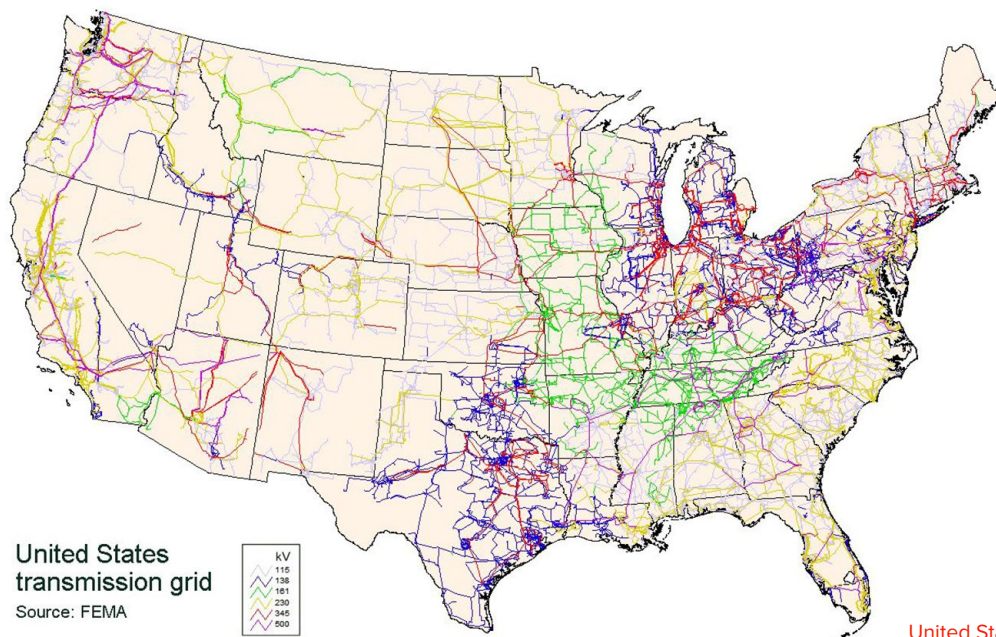
Aerial LiDAR and imaging surveys are wonderfully suited to vegetation management for a number of reasons. First, all vegetation (or anything else) in the ROW that penetrates the mandated MVCD or, alternatively the “maximum canopy height” imposed on the corridor by the transmission owner, is mapped with precise 3D locations. A LiDAR/Imaging survey does not “miss” any clearance issues unlike field observers. In addition, the corridor can be inspected in great detail

“All transmission lines subject to this regulation are to be inspected annually; and 100% of the vegetation work plan must be completed each year.”

This new standard places the highest priority on the management of vegetation to prevent vegetation grow-ins but is not intended to prevent customer outages due to tree contact with lower voltage distribution system lines. Since vegetation growth is constant and always present, unmanaged vegetation poses an increased outage risk and presents a significant risk of cascading

be completed each year. This work plan details how the Owner will manage vegetation to prevent encroachments into the MVCD. As important as this new standard is to lessen the risk of outages caused by vegetation, it does not prescribe “how” the annual inspection of corridors is conducted.

LiDAR service providers have done an excellent job over the last decade



United States transmission grid.

by professionals in the office saving a considerable amount of field work and expense. Canopy intrusions anywhere throughout the ROW corridor are mapped with precision. Vegetation that could now or in the future be “fall-ins”

standard. The 3D data files are available for inspection at any time using LiDAR height, intensity and classifications. Multiple LiDAR surveys over time can be used to generate canopy “growth” models that can be used to

in a familiar form easily accessible back at headquarters.

NERC’s FAC-003-2 reliability standard is designed to improve the reliability of our nation’s transmission infrastructure by preventing outages caused by vegetation encroachment. The entire infrastructure must be inspected each year. Compliance by transmission owners is mandatory and enforceable. LiDAR and imagery data has been used for years to provide a rich, complete source of 3D spatial information and has provided great value to ROW managers. This same technology in the skillful hands of remote sensing professionals will continue to provide enormous value to transmission owners as they work to comply with this new standard. ■

“Using LiDAR, the corridor can be inspected and mapped in great detail by professionals in the office saving a considerable amount of field work and expense.”

is easily spotted and mapped. These clearance issues can then be provided to the transmission owner on a map or in a report that facilitates immediate action.

LiDAR/Imaging surveys provided by reputable service providers offer a number of other important benefits. They provide a rich source of inspection documentation required by this

find change and even predict the need for vegetation treatment regimes. In addition, important topographic details about distance, slope, obstructions, planimetric features, and conditions in the field are also included with the LiDAR/Imaging surveys. This information provides a complete operational understanding of the ROW to managers

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