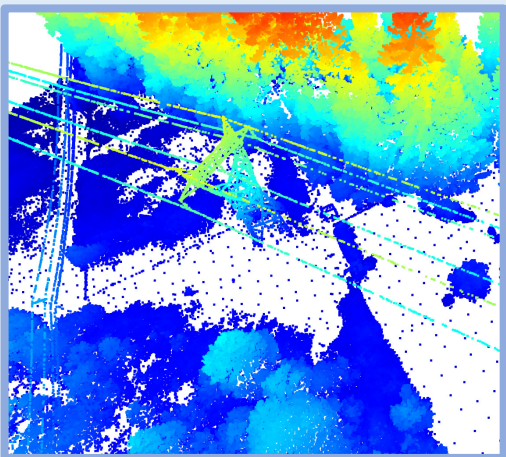


IDENTIFYING AT-RISK OVERHEAD TRANSMISSION SPANS FOR EXCEEDING THERMAL LIMITS AND LIGHTNING STRIKES

Improving Methods for Locating and Ranking Critical Spans



Example of critical span at risk of thermal overload due to dense nearby vegetation

PROJECT HIGHLIGHTS

- Identifying spans that are most prone to exceed thermal limits:
 - For determining the appropriate location of DLR and AAR sensors
- Identifying spans that are most prone lightning strike:
 - For determining the appropriate location of lightning mitigation tools

Background, Objectives, and New Learnings

In 2023, EPRI researchers began developing guidance and methods to identify what are known as critical spans. The performance of an entire circuit is limited by the weakest link in the chain. This weak link is the 'critical span.' In the context of transmission ampacity these spans are often most sheltered from local winds. When the wind cannot reach and cool specific spans, they may become thermally damaged, or cause clearance issues reducing safety and reliability.

Existing tools such as clearance analysis using CADD tell us what spans can be an issue *if* they operate above design limits; but not which spans *will* operate above design limits. This results in both false positives and false negatives causing utilities to undertake unneeded projects while still being exposed to risks. Another approach has been to consider weather data from models or airports which does not reflect the true field conditions and again results in errors. When attempting to apply DLR technologies commercial providers may also use these approaches resulting in circuit ratings that are inaccurate and installing a larger quantity of hardware than is required to solve congestion challenges. The objectives of this project are:

- Apply the existing equations to identify critical spans:
 - Confirm analysis with manual review
 - Improve efficiency and accuracy of the detection methods
- Help utilities understand how to apply the results:
 - Identify spans at risk of thermal overload
 - Identify spans at greater risk of lightning strike

The 2023 research indicated spans most critical from an ampacity perspective are expected to have above average lightning performance. The objects that block the wind may also become lightning attractors. Therefore, utilities in lightning prone areas would also learn about which spans may be most at risk of lightning strike and in most need of strategic reinforcement. This could include for example application of transmission line surge arresters.

Benefits

Utilities seeking to more efficiently apply AAR (ambient adjusted ratings) or DLR could benefit from understanding where spans at risk of exceeding thermal limits are located. The location and proximity of critical spans are a significant driver in the accuracy and costs associated with DLR.

Utilities seeking to better understand lightning performance may gain a rapid understanding of the circuits or spans where detailed analysis is merited relative to neighboring assets.

The industry could benefit from the improvements made to the critical span detection framework. These advances will be based on lessons that can only be learned by applying the framework and tools with member utilities.

The public at large is expected to benefit from the increased safety, reliability, and efficiency of operation that includes accurate determination of at-risk span locations.

Project Approach and Summary

The project is anticipated to follow this approach:

1. Identify problem circuits which are of most value for study; these may historically have a high outage rate or congestion.
2. Collect data needed to apply critical span detection tools such as line route maps, LiDAR data, and digital elevation models.
3. Process the available data and provide a ranking of criticality per span. Followed by manual review and iteration if needed to improve results.
4. Demonstrate to the utility engineers how to interpret and apply the results for decision making.
5. Utilize findings to develop and refine an algorithm to automate the detection of at-risk spans.

Deliverables

- Overview of the critical span detections, ranking process, and analysis results (either as a report or PowerPoint)

Price of Project

The project price is \$50k for each utility, with a minimum of four utilities need to complete the full scope of work.

Project Status and Schedule

The project is expected to last 18 months from the kickoff date.

Who Should Join

This project is of greatest value to utilities seeking to:

- Understand the quantity and location of DLR deployments required to rate a circuit/system
- Target inspection activities toward the most at-risk spans
- Understand where clearance violations and line failures are more likely
- Identify locations that would be of most and least benefit in lightning studies

Contact Information

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