

## DIRECT EMBEDMENT FOUNDATION BACKFILL PERFORMANCE



### PROJECT HIGHLIGHTS

- Literature review of available backfill options
- Evaluation of performance of different backfill solutions
- Evaluation of backfill installation techniques
- Guidance on optimizing the selection and application of foundation backfills

### Background, Objectives, and New Learnings

Transmission structure foundations are an integral part of the transmission system, responsible for transferring climatic loads into the soil. Of those, direct embedment pole foundations are the most commonly used and cost-effective system available to engineers. These foundations rely upon an effective backfill which serves as an intermediary between the pole and native soil. As such, the backfill material and installation procedures can greatly affect the overall performance and reliability of the foundation system.

Despite its importance, research focusing specifically on the impact of backfill on direct embedment foundation performance has been limited. Engineers have difficulty in appropriately specifying the backfill materials and installation procedures, verifying whether backfill has been installed properly, or accurately specifying backfill parameters during the design process.

This project intends to conduct a series of lateral foundation tests on direct embedment foundations systems to understand the relationship between backfill material and installation procedures and foundation performance. It will aim to assist engineers in improving the reliability of transmission foundation systems, as well as address the following research questions:

- What is the impact of backfill material type on foundation performance?
- What are the optimal backfill installation procedures to achieve a reliable foundation system?
- What backfill parameters should be used by engineers when designing direct embedment foundation systems?
- How can the quality of foundation backfill installations be verified in the field?

### Benefits

The societal benefits of this project include increased reliability of transmission structure foundations, a reduction in foundation failures, reduction in associated maintenance activities, and an increase in safety would be anticipated from optimizing foundation backfills.

Benefits to project funders include more accuracy and confidence in the design and installation of direct embedment foundations. This would help correct prevailing conservative or non-conservative design practices where they exist. Ultimately this would lead to a reduction in risk and reduced operational costs associated with transmission foundations.

## Project Approach and Summary

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The following high-level tasks define the project approach:

- 1. Review and Testing of Available Backfill Material:**  
The project will begin with a literature review of backfill materials available to transmission engineers including aggregates of various grain size distributions (GSD), concrete, and foam. Select materials will be chosen for laboratory testing to verify baseline properties. High potential materials will then be incorporated into the full-scale testing program.
- 2. Full-Scale Lateral Foundation Testing:** A series of lateral foundation tests to failure will be completed. Independent test variables will include backfill material, backfill installation and compaction procedures, and foundation annulus size. For each test, foundation geotechnical capacity and movement will be recorded.
- 3. Publication of Utility Recommendations:** Based on the results of the full-scale testing program, recommendations will be provided to members on how to optimize the performance of direct embedment foundations.

## Deliverables

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A report and presentation will be developed highlighting:

- Summary of findings from the literature review
- Details on test procedures and results from the full-scale lateral foundations test
- Recommendations for ways to optimize foundation backfill performance
- Recommendations for backfill parameters to use in foundation design with commercial software
- Documentation of the installation procedures used by EPRI in its foundation testing program

## Price of Project

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This project is \$65k per funding member with a minimum of eight (8) members to complete the full scope of testing.

## Project Status and Schedule

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The project is estimated to take 24 months to complete from the kickoff.

## Who Should Join

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Any utility installing direct embedment foundations on their system regardless of typical design practices.

## Contact Information

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For more information, contact the EPRI Customer Assistance Center at 800.313.3774 ([askepri@epri.com](mailto:askepri@epri.com)).

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