Supplemental Project Notice

ERGONOMICALLY ENHANCED TOOL FOR MANHOLE AND VAULT COVER REMOVAL: PHASE II

PROJECT HIGHLIGHTS

- Field-tested innovative tool design to manually move manhole and vault covers
- May help reduce the incidence, severity, and cost of injuries to utility workers
- Enhances safety in distribution operations through application of EPRI's ergonomics research expertise

Background, Objectives, and New Learnings

Electric and gas utilities with service areas in densely populated metropolitan areas have many of their distribution lines and infrastructure located underground. Access is obtained through manhole and vault covers, which are circular or rectangular plates on the street level. These plates can be opaque or have a mechanical grid for ventilation.

With large networks of underground infrastructure, utility workers must move covers to open and close manholes and vaults frequently during a shift. One utility has reported that the frequent daily movement of heavy covers has caused many physical injuries, or musculoskeletal disorders (MSDs), to their field workers. The magnitude of manual force and body posture are two key risk factors for MSD injuries, so this Phase II design will help to reduce manual force and awkward body postures.

Phase 1 of the project focused on evaluating manhole cover removal processes and design of a battery assist tool that would reduce ergonomic risk associated with this activity. The tool incorporated a handle and hook configuration that is actuated by an electric motor assist. A battery powers the electric motor that results in the lifting and lowering of a manhole cover.

The objective of this research project is to review and assess the prototype manhole removal tool developed in Phase 1 for any changes and/or upgrades which will provide increased operability and risk reduction for manhole removal tasks. The project will include field tests and lab-based upgrades to develop a Phase II second-generation tool.

Benefits

Results from this project are expected to reduce the incidence, severity, and cost of MSDs to utility workers from manual movement of utility manhole and vault covers.

Such benefits could scale nationally and globally to the utility or other sectors with similar work requirements. This is particularly important going forward as utilities expand their underground infrastructure to support growing urban populations.

Project Summary

Manholes and vaults are accessed by workers removing circular or rectangular covers at street level. These covers are typically iron and heavy (up to 227 kg). Except on rare occasions, underground utility workers use manual tools to remove and replace covers. These tools are typically a hook and chain, a rigid bar with a handle (J-hook), or a lever (second-class lever). The objective of the prior project was to address the high risk of MSDs affecting utility workers with field tests of current work practices and design of a new tool. Based on field evaluation of the Phase I Power Hook Tool design, this powered tool reduced manual forces to an acceptable level.

Biomechanical results from this development revealed that the power hook reduced the peak lumbar torque by 7 to 56%, compressive forces by 6 to 30%, and shear forces by 9 to 49% at the L5-S1 level.

The EPRI team plans to conduct a Phase II segment of this project which will focus on evaluating and refining the tool developed in Phase I. This will include the following project steps:

- Task 1 – A site visit to evaluate the original tools performance and gather input from funding organizations to identify opportunities for operational improvement.
- Task 2 – Development and fabrication of a Phase II Power Hook tool for field testing.
- Task 3 – Once the updated tool design is completed, the tool will be field tested to assess the field performance and identify any changes or modifications that may be needed based on this testing.
- Task 4 – Any final adjustments and/or modifications that were identified in field testing will be integrated based on stakeholder feedback and field assessment.
- Task 5 – A final field test will be performed to verify performance and operational use of the Phase II Power Hook Tool. The EPRI team also plans to evaluate final tool performance at two organization sites from the Project Advisory Committee to help ensure the new tools' effectiveness in the field and work site settings.
- Task 6 – A final technical report will be developed, and manufacturing drawing and blueprints will be completed.

Deliverables

- Technical report detailing the project methodology and associated CAD drawings for fabrication.
- Fact Sheet on the final tool operation.
- Training presentation on the operation of the final tool.

Price of Project

$250K Total/$50K per participant

The cost can be distributed over two years. This project qualifies for the use of Self-Directed Funds (SDF).

Five funding companies are required to start work.

Project Status and Schedule

EPRI anticipates a start date on January 1, 2024, with completion by February 28, 2026.

Who Should Join

Organizations with underground networks of electric and gas transmissions and distribution.

Contact Information

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

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