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CALTRANS DIVISION OF RESEARCH, INNOVATION AND SYSTEM INFORMATION
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Research Notes

Evaluation of Electric Vehicle (EV) Heavy Equipment for Use in Caltrans' Operations

To evaluate the use of EV heavy equipment in California Department of Transportation (Caltrans) maintenance operations.

Maintenance

November 2025

Project Title:
Evaluation of Electric Vehicle (EV) Heavy Equipment for Use in Caltrans' Operations

Task Number: 4307

Start Date: June 18, 2024

Completion Date: September 30, 2026

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WHAT IS THE NEED?

The heavy equipment currently used in the Caltrans maintenance operations such as loaders and excavators are powered by diesel fuel which results in high carbon emissions. There is a need to find alternative to the gas-powered heavy machinery that is reliable and can reduce tailpipe emissions. Electric machines are identified as a suitable substitute for the current technology. Transitioning to electric equipment will eliminate the tailpipe carbon emissions and will reduce the environmental impact of relevant operations. These electric machines are especially suitable for operations in enclosed spaces and in dense, low-income regions, where the health hazards from fine particulate emissions are an additional concern.

This project will help Caltrans understand the latest progress in the development of EV heavy equipment and will identify challenges and opportunities associated with the integration of EV heavy equipment in Caltrans fleet. This project also aligns with the State of California's mission to roll out 100% zero-emission heavy-duty vehicles by 2045.

WHAT ARE WE DOING?

In this project the contractor, Advanced Highway Maintenance and Construction Technology (AHMCT) research center, UC Davis will perform product search and gather information (on the commercially available EV heavy equipment that meets Caltrans' needs), work with project panel to select a commercially available EV heavy equipment for evaluation, acquire the selected equipment, develop test plan, and perform field testing and evaluation of the equipment to assess its suitability for Caltrans maintenance

Caltrans

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operations. The Caltrans maintenance personnel will be trained to operate and maintain the equipment. The evaluation of EV heavy equipment in this project will also include collection of feedback from Caltrans maintenance personnel regarding their experience in operating the EV heavy equipment. This project will result in a final report summarizing the results and deliverables, including recommendations for further adoption of EV heavy equipment in Caltrans' fleet.

WHAT IS OUR GOAL?

The goal of this project is to address questions such as the availability of EV heavy equipment, suitability of EV heavy equipment for Caltrans maintenance operations, challenges associated with the integration of EV heavy equipment in Caltrans fleet, training needs for Caltrans staff to operate and maintain the EV heavy equipment, potential benefits of its adoption in Caltrans fleet, and the recommendations on whether or not to adopt the EV heavy equipment in Caltrans fleet.

WHAT IS THE BENEFIT?

The adoption of EV heavy equipment will reduce carbon emissions and thus the environmental impact of Caltrans maintenance operations. The elimination of tailpipe emissions reduces possible health hazards related to activities in confined spaces for Caltrans workers. In addition, the electric machines have fewer moving components compared to their gas-powered counterparts. Therefore, it is expected that they will require less maintenance and have lower downtime and a longer lifespan.

WHAT IS THE PROGRESS TO DATE?

Worked with customers and contractor to finalize the proposal for this research project. Contract was executed and informed contractor to start work on this contract starting June 18, 2024. Scheduled the kick-off meeting on July 8, 2024. A contingency request was approved to increase the funds to rent the EV Heavy Loader. The customer is in the process of renting the equipment.

The EV Heavy Loader was delivered to META on August 6, 2025, with testing and evaluation commencing immediately upon arrival. On the same day, a Warrior Machinery technician provided on-site training. Operator feedback is currently being collected, and an initial analysis has already been completed. Additionally, a data acquisition beacon has been installed to support online data collection. Noise level testing has been performed, and the resulting data is now available for analysis.

IMAGES

Image 1: Noise Level Evaluation using Extech SDL600

Image 2: EV Heavy Loader Ready for Operation Training