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CALTRANS DIVISION OF RESEARCH, INNOVATION AND SYSTEM INFORMATION

TRANSFORMING IDEAS INTO SOLUTIONS

Research Notes

Lifetime Cost-Benefit Analysis of Mobile DC Fast Chargers

This research project plans to evaluate the economic and operational feasibility of using Mobile DC Fast Chargers (MDCFCs) within California Department of Transportation (Caltrans) operations, focusing on their potential to enhance operational flexibility, reduce costs, and support the agency's transition to a more sustainable fleet.

Equipment

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Project Title:
Lifetime Cost-Benefit Analysis of Mobile DC Fast Chargers

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WHAT IS THE NEED?

Caltrans faces substantial challenges in expanding its electric vehicle (EV) charging infrastructure to meet the increasing demands of its electric fleet. This shortage of EV chargers leads to significant wait times for critical vehicles, disrupting essential functions like maintenance, emergency response, and roadside assistance. Such disruptions affect fleet efficiency and delay services that are critical to Caltrans' operations and broader sustainability objectives. Incorporating flexible, scalable charging solutions such as MDCFCs presents a promising option. MDCFCs can be deployed in areas lacking permanent infrastructure or where temporary demand spikes, such as at remote job sites or during emergency responses. These mobile chargers would provide operational adaptability, ensuring critical fleet support even in locations with limited or no grid connectivity. Before committing to MDCFCs, conducting a comprehensive Lifetime Cost Analysis (LCA) is essential. The LCA would provide insights into the total lifetime costs and benefits associated with MDCFCs, factoring in acquisition, operational, and maintenance expenses, as well as eventual replacement costs.

WHAT ARE WE DOING?

This research project aims to evaluate the potential benefits and challenges of integrating Mobile DC Fast Chargers (MDCFCs) into Caltrans operations to support its growing fleet of EVs. MDCFCs offer a flexible and scalable solution for addressing charging infrastructure gaps, especially in areas where permanent stations are not feasible or require significant investment. A comprehensive Lifetime Cost

Caltrans

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Analysis (LCA) will assess the total costs – including acquisition, operational, maintenance, and end-of-life costs – while also examining potential financial benefits such as fuel savings, lower emissions-related costs, and increased operational efficiency. By thoroughly analyzing these factors, the project will provide Caltrans with the data needed to make informed decisions on optimizing EV charging infrastructure, reducing environmental impact, and supporting California's transition to a zero-emission transportation system.

WHAT IS OUR GOAL?

The goal of this project is to conduct a detailed evaluation of Mobile DC Fast Chargers, and to determine if the investment in MDCFCs delivers sufficient financial and operational benefits over their lifespan, ensuring the efficient allocation of Caltrans' resources.

WHAT IS THE BENEFIT?

The results of this project will offer guidance for Caltrans Division of Equipment staff by providing with critical insights into the cost-effectiveness of investing in MDCFCs to support its transition to a zero-emission fleet.

WHAT IS THE PROGRESS TO DATE?

The project panel kickoff meeting took place on June 10, 2025, followed by a coordination meeting with Caltrans and the ZEV Planning Tool team on August 14, 2025. During the meeting, the team reviewed the ZEV Planning Tool and its data sources, agreeing to provide specific datasets upon request. Access to the Caltrans Geotab dataset was confirmed. An extensive literature review was conducted, including top-tier journals, conference papers, and scientific and technical reports. Preliminary data extraction from the past six months of fleet trip history was completed, and an initial vehicle usage analysis was performed across four representative Caltrans sites.

The contract-based pricing information from Caltrans for mobile Direct Current (DC) fast charger units was obtained, which will be used as the reference cost data for the analysis. The evaluation was narrowed to the Kempower and Xos Hub units, as both systems are already deployed within the Caltrans fleet and have established contract pricing. This provides a consistent, practical, and defensible basis for the comparative cost analysis. In addition, development and formulation of the cost model were initiated to support evaluation of deployment scenarios, operational considerations, and lifecycle cost comparisons.