DRISI
Caltrans Division of Research, Innovation and System Information

Research Notes

Routing of Battery Electric Heavy-Duty Trucks for Drayage Operations

Examining the potential for battery-electric, heavy duty trucks for environmental benefits.

Planning, Policy and Programming

NOVEMBER 2022

Project Title:
Routing of Battery Electric Heavy-Duty Trucks for Drayage Operations

Task Number: 3369

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WHAT IS THE NEED?

California has a long history of air quality regulation. With the passage of Assembly Bill 32 (AB 32) in 2006, California became the first state to establish greenhouse gas (GHG) reduction targets and a comprehensive program to achieve them. California still has some of the most serious air quality problems in the nation.

The combination of aggressive GHG reduction targets, the increasing share of pollution from trucks, and environmental justice problems from the state's ports, has led to vigorous efforts to reduce truck emissions. Through a series of regulations, subsidies from the state's cap and trade program, and state-funded demonstration programs, California is seeking to accelerate the adoption of zero emission vehicles (ZEV) and near-zero emission vehicles (NZEV). A major target is the short-haul trucking sector.

This work will build on an earlier study funded by the South Coast Air Quality Management District (SCAQMD). In this study, the researchers developed an optimization and simulation model and used actual drayage (transport of freight from port to destination, the first mile) trip data from the ports of Los Angeles and Long Beach to generate a set of simple (single or two stop) drayage to be accomplished over a single 8-hour shift day.

Drayage service is defined as short haul pick-up and delivery of goods to and from ports, warehouse and distribution centers, and intermodal facilities.

WHAT ARE WE DOING?

The researchers propose to use optimization and simulation modeling to explore the impacts of using battery electric heavy-duty trucks in freight operations (e.g., fleet size) and emissions. Specifically, they will focus on heavy duty trucks used in short-haul drayage services.

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WHAT IS OUR GOAL?

This research will examine the potential for battery electric, heavy duty trucks with respect to fleet size, and environmental benefits. The end product will be a simulation model that will generate: 1) total vehicle miles travelled required to satisfy the daily demand; 2) the number of vehicles (diesel, and battery electric heavy-duty trucks) required; and 3) the corresponding pollution and greenhouse gas emissions.

WHAT IS THE BENEFIT?

This project would significantly advance the findings of the earlier study by incorporating more realistic routes, allow for battery charging outside the ports, and model unequal cargo loads. The latter feature would allow for a more accurate estimate of the emissions of the various scenarios.

Furthermore, achievement of a zero-emission vehicle fleet is part of long-range plans for California, the Southern California Air Quality Management District (SCAQMD), San Pedro Bay Ports and many local jurisdictions. A zero-emission vehicle or near-zero emission vehicle fleet is core to achieving California's greenhouse gas emission reduction goals.

WHAT IS THE PROGRESS TO DATE?

We have developed the solution algorithm to solve the formulated optimization model. We validated the model through several operating scenarios from survey data from the ports of Long Beach and Los Angeles. We have continued with the development of solution algorithm. The next steps are to validate the models with experimental analysis of different operating scenarios and write the final report.

IMAGES

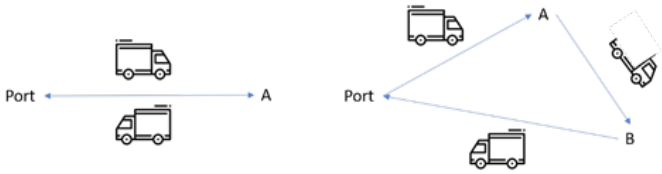

Image 1: Types of Trips a Truck can Travel