UNIVERSITY TRANSPORTATION CENTER
RESEARCH BRIEF

Optimal Charging Infrastructure Design for Battery Electric Buses

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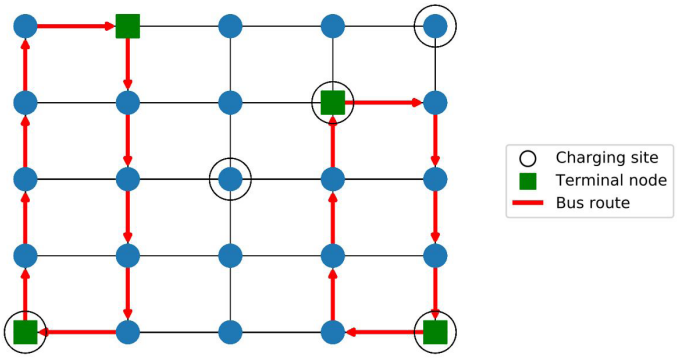
Background

The Pacific Northwest (i.e., US Region 10) is among the fast-growing regions in the nation. Many of its urban cores and suburban areas (e.g., Seattle and Portland) have experienced increasingly severe congestion and associated impacts such as emissions and decreased productivity. To address such issues, transit agencies across the region (e.g. the King County Metro Transit) have established ambitious goals to transition to "zero-emissions" bus fleets. In support of the zero-emissions fleet vision of transit agencies, battery electric buses (BEBs) will likely see widespread adoption. BEBs, like other electric vehicles (EVs), are powered by battery packs that supply an electric motor to turn the wheels. Since they do not use liquid fuels, BEBs do not produce tailpipe emissions. Therefore, BEBs powered by renewable energy sources can reduce both greenhouse gas emissions and air pollution in urban areas. BEBs are becoming more financially attractive as battery costs decrease, but their viability still depends on the existence of adequate charging infrastructure. Since existing EV charging infrastructure is scarce and primarily intended for private vehicles, one particular problem transit providers face is deciding where to locate charging stations for their buses. This decision impacts agencies' capital expenditures (i.e., installation of charging stations) and operations costs (i.e., service interruptions due to charging). Determining optimal locations for these stations can thus help accelerate the transition to BEBs, improving sustainability and health.



Research Project

The objective of this project is to develop models, methods, and procedures to determine the optimal locations of charging stations for BEBs and apply them in collaboration with transit agencies. The models and algorithms developed in this research need to integrate practical considerations and constraints such as the facilities and land (e.g., where the bus layover locations are) owned by transit agencies, the capacity of electricity grid networks, etc., calling for innovative modeling methods that are both mathematically rigorous and practically feasible. As local and regional transit agencies (e.g. King County Metro) are planning to procure and deploy BEBs, strategies for charging these buses are becoming more critical, which are yet to develop at transit agencies. This project can thus help these agencies to develop a reliable, efficient, and cost-effective BEB charging system while also generating novel academic research.

ABOUT THE AUTHORS

The research team consisted of Jeff Ban of the University of Washington.

ABOUT THE FUNDERS

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EXPECTED DATE OF COMPLETION

August 2022

FOR MORE INFORMATION

http://depts.washington.edu/pactrans/research/projects/optimal-charging-infrastructure-design-for-battery-electric-buses/