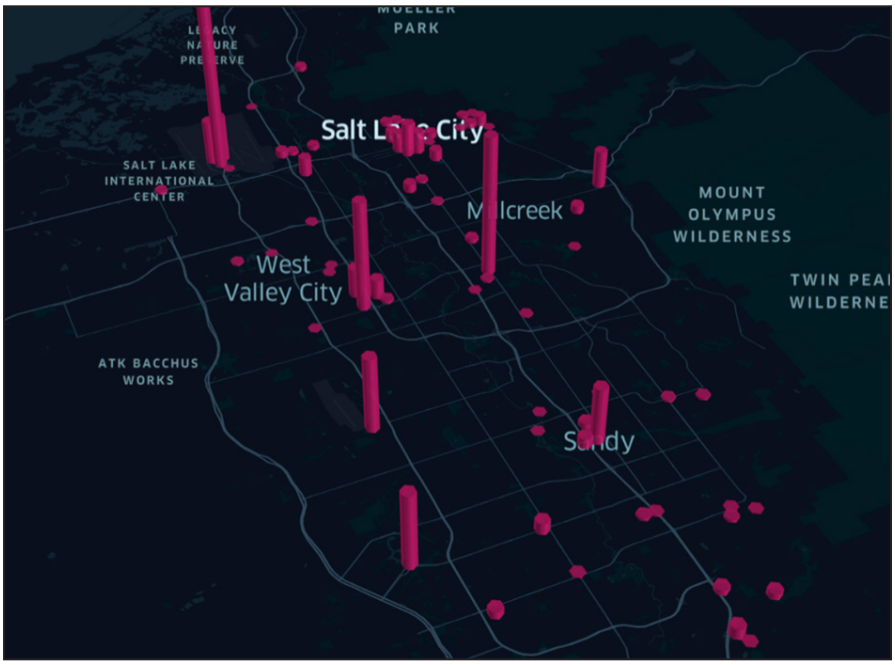
MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 24-566 (project 697) | October 2024

A Microscopic Approach for Electric Vehicle Demand Estimation



the **ISSUE**

With the increasing adoption of electric vehicles (EVs), particularly in rapidly growing regions like the Salt Lake City (SLC) metropolitan area, efficient deployment of charging infrastructure is critical to avoid overloading the power grid and to meet the charging needs of EV users. Research is needed to link potential EV users' daily activity patterns with their charging behavior and further estimate the spatial distribution of public charging demand. Research is also needed to learn how to optimize the layout of public charging stations such that the overall public charging demand is maximized.

the **RESEARCH**

The research was conducted in two phases. The first phase involved simulating public charging demand through an agent-based modeling approach using MATSim. The model synthesized high-resolution daily driving profiles based on sociodemographic attributes and historical trip data. EV assignment and energy consumption models were applied to determine the distribution of public charging demand. The second phase focused on optimizing the location of public charging stations using a capacitated maximal coverage location problem model. This model reallocated existing charging stations while maximizing coverage of the charging demand, all while under constraints such as investment costs and charging load capacities.

MOUNTAIN-PLAINS CONSORTIUM REGION 8

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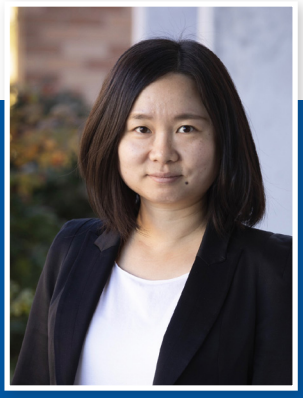

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Project Title

A Microscopic Approach for Electric Vehicle Demand Estimation

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Global Energy Interconnection Research Institute North America (GEIRINA)

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the **FINDINGS**

Major findings of the study revealed that the optimized layout of charging stations significantly improved the overall performance of the public charging infrastructure. By using real-world charging data to validate the simulation results, the optimized network was able to reduce the number of EV drivers with zero state-of-charge by 20% and decrease the average charging time from 2.8 hours to 2.5 hours. Additionally, the model identified areas in the SLC metropolitan region with high charging demand but insufficient charging infrastructure, highlighting the need for strategic planning in expanding charging networks.

the **IMPACT**

The entire framework is capable of modeling the spatiotemporal distribution of public charging demand in a bottom-up fashion, and providing practical support for future public EV supply equipment installation. This research has important implications for cities seeking to accelerate EV adoption while ensuring that public charging infrastructure can meet future demand. The outcomes provide actionable insights for urban planners and policymakers, offering a scalable framework for optimizing public EV supply equipment deployment to support sustainable transportation systems.

For more information on this project, download the Main report at https://www.ugpti.org/resources/reports/details.php?id=1229

For more information or additional copies, visit the Web site at www.mountain-plains.org, call (701) 231-7767 or write to Mountain-Plains Consortium, Upper Great Plains Transportation Institute, North Dakota State University, Dept. 2880, PO Box 6050, Fargo, ND 58108-6050.

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