Co-locating Electric Charging Stations and Parking Facilities for Agricultural Freight Trucks for Efficient and Resilient Agricultural Supply Chain in California – Project 8

Deliverables and Reporting Requirements for UTC Grants Awarded in 2023 (June 2023)

Exhibit D

Recipient/Grant (Contract) Number: The University of Tennessee; California State University, Long Beach, Grant No. 69- A3552348338

Center Name: Center for Freight Transportation for Efficient and Resilient Supply Chain (FERSC)

Research Priority: Improving Mobility of People and Goods

Principal Investigator(s): Shailesh Chandra (CSLB), Linna Li (CSLB)

Project Partners: Caltrans, California Air Resources Board

Research Project Funding: $75,000 Federal and $113,117 non-Federal funding

Project Start and End Date: 07/01/2024 – 06/30/2025

Project Description: The objective of this proposed research is to study the potential of co-locating electric charging stations and parking facilities for freight trucks in California – a recommendation by Caltrans in its recent report on California Truck Parking Study 2022. This proposed research will focus on identifying such locations (as shared infrastructure) for charging stations and parking that will specifically cater to agricultural freight trucks of California and supporting its vital agricultural supply chain.

With the strategically identified points of electric charging stations (at truck parking facilities), the goal will be to minimize the distance traveled by agricultural freight trucks to recharge, thus reducing transportation costs. This cost reduction will positively impact on the entire supply chain by making agricultural products more affordable for consumers. With readily available charging and the parking infrastructure, agricultural freight trucks can maintain their schedules more efficiently. This would reduce downtime for recharging and would ensure timely delivery of perishable agricultural goods to markets, improving overall operational efficiency in the supply chain.

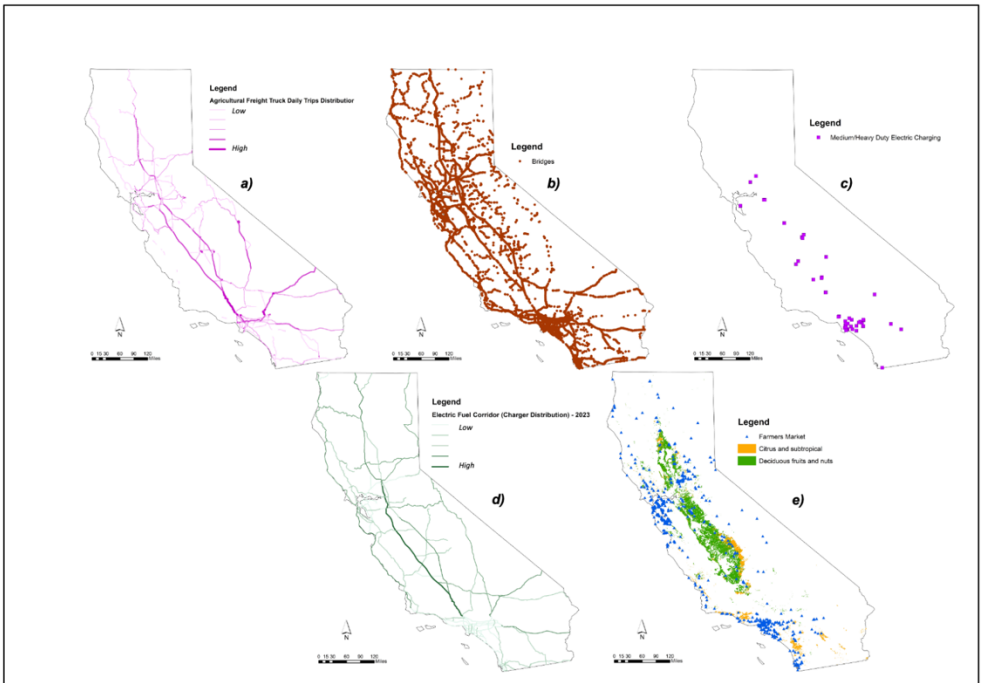

Figure 1: Spatial distribution of variables as model inputs- a) prominent agriculture freight truck corridors, b) bridges, c) proposed/existing medium/heavy-duty charging facilities, d) California-designated electric fuel corridor, and e) farmers market.

Finding suitable locations for agricultural freight truck charging stations requires unique considerations beyond those for standard electric vehicle (EV) charging infrastructure. This includes navigating limited parking options due to local regulations and factoring in elements such as the proximity to major trucking routes, the weight capacity of aging bridges, the use of existing medium/heavy-duty charging outlets to reduce costs, the closeness to existing electric fuel corridors, and the

potential for charging facilities at farmers markets. The map in Figure 1 displays the spatial data for these variables, illustrating the challenge in using these data for optimization. Subsequently, data collection will be carried out through a survey/workshop among agricultural supply chain stakeholders (including agricultural freight truck owners/operators and farmers, distributors etc.) to identify relative weights for each of the variables in Fig. 1.

Typically, regional EV charging facility location problems are tackled using complex optimization models solved by advanced programming techniques. However, our proposed research intends to apply simpler geographical information system (GIS)-based methods for location optimization, which have not been previously utilized for the specific purpose of co- locating electric charging stations at parking facilities considering multitude of factors/variables.

US DOT Priorities: i) Improving Mobility of People and Goods, and ii) Preserving the Environment.

Outputs: The outcomes of the research will be disseminated through presentations at professional meetings, including meetings of the TRB Committee on freight transportation. Moreover, these findings will be submitted for publication in high impact factors journals like the Journal of Transport Geography and Transportation Research Part E: Logistics and Transportation Review. Furthermore, the PI and his team plan to communicate the insights gained from the research to local communities and public agencies, including Caltrans and key agricultural distributors of California. The PI will develop lecture modules in key transportation courses of the civil engineering department. Both undergraduate and graduate level courses will have term projects in these courses that will require them to identify and explore the various challenges associated with setting up charging infrastructure for agricultural freight trucks in California.

Outcomes/Impacts: The outcome of this approach would yield a fast yet a robust process of identifying an optimal site considering infrastructure constraints for the co-location of EV charging stations and parking tailored for agricultural freight trucks in California. Furthermore, unlike the typical facility location modeling approach, our method would not require the information of an exact origin-destination (O-D) agricultural freight truck flows for determining the optimal sites. Additionally, as these agricultural freight trucks are heavier than their standard diesel-fueled counterparts and navigate aging bridges on these corridors, this research project also seeks to consider the bridge infrastructure readiness for the optimal co-location.