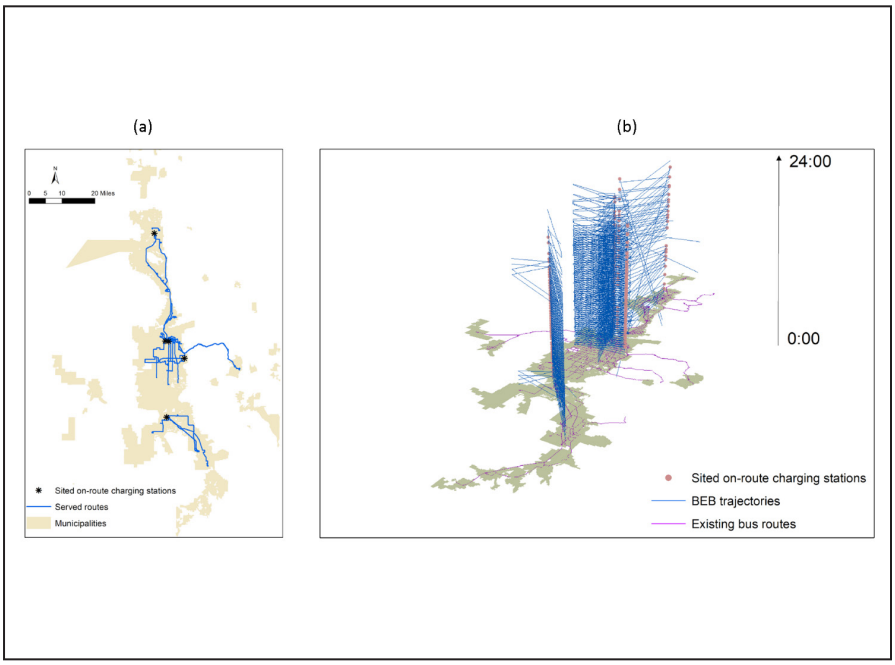
MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 18-355 (project 527) | July 2018

Strategic Planning and Design for Electric Bus Systems



the ISSUE

Battery electric buses (BEBs) with zero-emission has been recognized as a promising alternative to diesel and compressed natural gas bus to advance air quality and save fuel costs. The adoption of BEBs requires important decisions in deploying electric buses and charging stations, including identifying appropriate driving range for BEBs, allocating BEBs to appropriate transit routes, and determining locations of charging stations and their corresponding capacities that can charge the BEBs in a cost and time-effective way. There was no research that investigated the system design for BEBs and associated infrastructure.

the RESEARCH

The strategic planning and design for BEB systems is essential for transit agencies to implement the electrification of the public transportation. This research will help transit agencies make informed decisions regarding strategic planning and design for BEB systems by achieving the following specific objectives:

1. Develop a systematic approach to identify optimal deployment strategies for BEB systems to achieve specified planning goals; and
2. Create a software tool to assist transit agencies in conducting the BEB deployment.

Specifically, a spatio-temporal optimization model is developed to minimize the cost of replacing a certain number of diesel or CNG buses (part of the fleet) with BEBs, while in compliance with existing bus operation routes and schedules. The proposed model can be used to determine the optimal spatio-temporal allocation of the BEBs, as well as the associated on-route charging stations and in-depot charging stations.

MOUNTAIN-PLAINS CONSORTIUM REGION 8

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University of Denver
University of Utah
Utah State University
University of Wyoming

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the **FINDINGS**

This research develops a spatio-temporal analytical method to assist agencies in identifying the optimal deployment strategies for BEB system using a combination of Geographic Information System (GIS) and optimization techniques. The application results demonstrate that the framework is effective in selecting the retrofitted buses, routes and charging stations within a transit network for BEB deployment. The method is able to identify the optimal spatio-temporal deployment for BEBs and charging stations that can minimize the deployment cost of replacing a certain number of diesel or CNG buses with BEBs, while satisfying transit operation constraints such as maintaining existing bus operation routes and schedules.

the **IMPACT**

As many transit agencies are testing BEBs and considering the integration of BEBs into future fleet, this research sets the foundation for agencies to evaluate the capital and operational costs associated with deployment of various types of BEBs, and make informed decisions regarding strategic planning and design of BEB systems.

For more information on this project, download the entire report at http://www.ugpti.org/resources/reports/details.php?id=913

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.