2016 UDOT RESEARCH PROBLEM STATEMENT

****** Problem statement deadline is March 14, 2016. Submit statements to Tom Hales at tahales@utah.gov. ******

Title: Strategic planning and design for electric bus systems **No. (office use):** 16.06.01

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UDOT Champion (suggested):

Select One Subject Area

- ☐ Materials/Pavements
- ☐ Maintenance
- ☐ Traffic Mgmt/Safety
- ☐ Preconstruction
- ☐ Planning
- ☒ Public Transportation

1. Describe the problem to be addressed.

Electric bus with zero-emission has been recognized as a promising alternative to diesel and compressed natural gas (CNG) bus to advance air quality and save fuel costs. The adoption of electric buses requires significant investment and needs strategic and comprehensive planning on how to deploy electric buses and associated infrastructure (e.g., charging stations). Important decisions in deploying electric buses and charging stations will include, among others, identifying appropriate driving range (battery specification) for electric buses, allocating electric buses to appropriate transit routes, and determining locations of charging stations and their corresponding capacities that can charge the electric buses in a cost and time-effective way. This research will use and develop a combination of GIS and optimization methods to help transit agencies make informed decisions regarding strategic planning and design for electric bus systems.

2. Explain why this research is important.

The strategic planning and design for electric bus systems is essential for transit agencies to implement the electrification of the public transportation. While previous research has investigated the system design of public infrastructure for private electric vehicles, no research currently exists investigating the system design for electric buses and associated infrastructure. This research fills this gap by developing a systematic approach to identify optimal deployment strategies for electric bus systems. As the UTA is testing electric buses and considering the integration of electric buses into future fleet, this research will help the UTA evaluate the capital and operational cost, greenhouse-gas emission reduction and fuel cost saving associated with the integration of electric buses, and make informed decisions.

3. List the research objective(s):

1. Develop a systematic approach to identify optimal deployment strategies for electric bus systems to achieve specified planning goals.
2. Evaluate the cost (capital and operations) and benefits (emission reduction and fuel cost saving) of electric bus fleets in comparison with the diesel or CNG fleets.

4. List the major tasks:

1. Investigate available driving ranges for electric buses and their deployment feasibility for transit routes;
2. Investigate the feasibility and potential capacity of bus terminals for deploying on-route charging stations;
3. Develop and use a combination of GIS methods and optimization models to identify the optimal deployment strategies for electric buses and charging stations to achieve the specified planning goals;
4. Evaluate the cost and benefits associated with the adoption of electric buses and create recommendations based on data analysis and results;
5. Author a final report outlining the process and methods as well as the outcomes from steps 1-4.

5. List the expected results:

1. A systematic approach to identify the optimal deployment strategies for electric bus systems to achieve specified planning goals;
2. Cost and benefits analysis associated with the adoption of electric buses.

6. Describe how this research will be implemented.

This result will provide a systematic approach to identify the optimal deployment strategies for electric bus systems to achieve specified planning goals. This approach can assist the UTA with the strategic planning and design of the electric bus system. In addition, given the identified deployment strategies, the cost and benefits associated with the deployment can be examined. The analysis results will serve as a reference to inform decisions on the adoption of electric buses.

7. Requested from UDOT: $30,000 **Other/Matching Funds:** $20,000 **Total Cost:** $50,000
(or UTA for Public Transportation)

8. Outline the proposed schedule, including start and major event dates.

The following schedule is proposed to give a general idea of the relative timing of the major event dates. The University of Utah will work with the research manager, project champion, and UTA to finalize the scope and schedule.

Start Date – July 1, 2016
Electric Bus and Transit Route Feasibility Analysis Completion – August 31, 2016
On-route Charging Station and Bus Terminal Feasibility Analysis Completion – August 31, 2016
Systematic Approach Development Completion – February 29, 2017
Cost and Benefits Analysis Completion – April 30, 2017
Approach Finalization and Final Report Completion – June 30, 2017