2016 UDOT RESEARCH PROBLEM STATEMENT

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

Title: Analysis of a Connector-Feeder Shared Autonomous Vehicle System **No. (office use):** 16.06.03

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Select One Subject Area

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

1. Describe the problem to be addressed.

One of the most challenging aspects of mass transit systems is the last mile problem: getting travelers from a final transit stop to their ultimate destination. If distances are too far, travelers may deem such systems ineffective and opt to travel by alternative methods. Different strategies have attempted to solve this issue, though these strategies each have their own drawbacks. For example, buses typically have high capacity but long headways and indirect routes, while bike sharing systems have rebalancing issues in terms of matching supply and demand (i.e., getting the bikes back to the stations where they are needed). Recent innovations in vehicle automation appear set to address these limitations, through the provision of low-speed shared autonomous vehicles (SAVs). SAVs may act as either fixed-route or demand-responsive vehicles, linking transit stations with traveler destinations (or origins, for the return trip). In many respects SAVs would operate similar to human-driven shuttles, though without the cost of a driver for each vehicle, operational costs could be much lower, potentially leading to a much larger fleet of smaller capacity vehicles, and enabling demand-responsive operation. For the purposes of this project, the University of Utah's would act as an analysis testbed, linking the University with the four Red Line stations that pass through campus.

2. Explain why this research is important.

Addressing the last mile problem through the use of SAVs should increase the accessibility of transit systems to a larger geographic coverage area. The benefits include increasing ridership, reducing automobile dependence, providing access to transit for households with no cars, and ultimately resulting in reduced regional congestion and air quality improvements. This proposed project would serve as an investigative analysis as to the feasibility, ridership potential and operations of such an SAV system, which would be necessary prior to deployment. Furthermore, the US DOT has proposed nearly $4 billion over a 10-year period in investments to accelerate the development and adoption of vehicle automation through real-world pilot projects. This research could help place UTA and UDOT in a strong position to compete for such funds.

3. List the research objective(s):

1. Identify existing pilot SAV systems that could be adapted for use in Salt Lake City, and alternative schemes for implementation as connector-feeders for University of Utah rail transit stations.
2. Evaluate feasibility, operations, and potential implications of the various alternative scenarios.
3. Recommend a preliminary preferred alternative and deployment plan.

4. List the major tasks:

1. Synthesize literature. Identify, review, and critically synthesize relevant published literature regarding existing and planned SAV pilot projects and studies, as well as pilot projects and studies for transit station connector-feeder systems. This synthesis shall include both demand-responsive and fixed-route systems.
2. Identify and scope deployment alternatives. Develop a set of preliminary potential alternative deployment scenarios based on literature synthesis, and work with the Technical Advisory Committee (TAC) to identify up to three deployment alternatives for further evaluation. Deployment alternatives may include factors such as SAV occupancy capacity, number of vehicles, fixed-route vs. demand-responsive operation, route or service area definitions, implementation variations on ridesharing service, and other factors.
3. Deployment alternative development and testing. This task shall seek to create statistical and simulation models to develop and test the implications of SAV deployment alternatives identified in Task 2. This task shall include a preliminary demand assessment using existing transit ridership data and statistical modeling analysis for potential ridership increase, in light of new SAV connector-feeder service. Additionally, individual SAVs and riders shall be micro-simulated across the campus network,

using the variety of alternative deployment schemes to define SAV fleet operational the parameters.

4. Scenario evaluation and recommendations. Document anticipated ridership (and changes in ridership from current levels), wait times, and travel times to and from rail transit stations for each deployment alternative scenario. Evaluate (order-of-magnitude) potential capital and operating costs across the various alternative deployments, and compare against performance metrics. Evaluate potential technical and other feasibility limitations for each of the alternatives (e.g., operation in snow). Identify and recommend a preferred alternative and deployment plan.
5. Submit final report. A Final Report will be prepared and submitted that documents the entire research effort, including preliminary literature synthesis, deployment alternative identification, development, testing and evaluation, incorporating feedback received from the TAC. Task 5 activities will follow UDOT Research Division's Final Report Process.

5. List the expected results:

1. Identification of and preliminary operational design for up to three SAV connector-feeder deployment alternatives.
2. Evaluation of estimated potential for increase in transit ridership service performance measures, and operational feasibility barriers or limitations across each of the evaluated deployment alternatives.
3. Recommendation of a preferred deployment alternative and future deployment plan.

6. Describe how this research will be implemented.

Findings will be presented to UTA planning and operations staff, as well as transportation planning staff from UDOT. These individuals may use the information stemming from this research in order to understand how such a system could be implemented in Utah, and the potential implications for transit ridership.

7. Requested from UDOT: $50K **Other/Matching Funds:** $40K* **Total Cost:** $90K

*A proposal for the $40K in matching funds will be submitted to the Mountain Plains Consortium, the U.S. DOT Regional University Transportation Center for Federal Region 8, which shall be used to supplement deployment alternative evaluation activities.

(or UTA for Public Transportation)

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

The proposed timeline will begin Sept. 1, 2016 and end Dec. 31, 2017, with major tasks as follows:

- Task 1 Synthesize literature (2 months): Sept. 1, 2016 – Oct. 31, 2016
- Task 2 Identify and scope deployment alternatives (2 month): Nov. 1, 2016 – Dec. 31, 2016
    - Meeting with TAC around Dec. 1
    - Technical memorandum detailing outcomes of first two tasks Dec. 31
- Task 3 Deployment alternative development and testing (8 months): Jan. 1, 2017 – Aug. 31, 2017
    - Technical memorandum detailing outcomes task three Aug 31
- Task 4 Scenario evaluation and recommendations (2 months): Sept. 1, 2017 – Oct. 31, 2017
    - Meeting with TAC around Sept 15
- Task 5 Submit final report (2 months): Nov. 1, 2017 – Dec. 31, 2017