UTC Project Information	
Project Title	MPC-469 – Improving Efficiency and Reliability of Bus Rapid Transit
University	Utah State University
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Funding Agencies	USDOT, Research and Innovative Technology Administration
Agency ID or Contract Number	DTRT12-G-UTC08, Modification No. 1
Project Cost	$259,600
Start and End Dates	April 1, 2014- July 31, 2017
Project Duration	3 Year
Brief Description of Research Project	Bus Rapid Transit (BRT) is an innovative, high capacity, lower cost public transit solution that can significantly improve mobility (National BRT institute, 2014). It is usually defined as an integrated system with a strong, transit-oriented identity, which consists of running ways (very often exclusive lanes), specially designed rail-like stations, high-capacity low-floor vehicles, improved services, and state-of-the-art Intelligent Transportation Systems (ITS) (Levinson et al., 2003). It provides similar quality of service as rail transit, at much lower construction and operational costs to the transit organization, and retains the flexibility of buses. BRT has the potential to significantly improve efficiency and reliability of public transit, which leads to an increase in the ridership. Certain *operational strategies* significantly help BRT in improving travel times, speeds and headway adherence, with the most beneficial seen from the implementation of Transit Signal Priority (TSP) and off-board fare collection (Zlatkovic et al. 2010). ITS technologies, such as GPS tracking devices, Automated Passenger Counters (APC), Ticket Vending Machines (TVM), advanced detection systems, signal performance monitoring systems etc., are now widely

	used by transit and state DOT agencies. These systems, by providing performance-related data, can be used to further improve the efficiency and reliability of these BRT systems. This research will focus on the evaluation and analysis of two operational strategies for improving the efficiency and reliability of BRT system: TSP and fare collection methods. The study will review different TSP systems (conventional detection vs. GPS, conditional active TSP considering ridership and schedule/headway adherence, and adaptive TSP considering a wide range of traffic and transit operations), and fare collection methods being used (prepaid, tickets sold by the driver, off-board TVMs, on-board TVMs), and quantitative analysis will be performed based on field and simulated data to evaluate the effectiveness of various strategies. The study will be on the basis of Utah Transit Authority (UTA) BRT system, however, the research result is quite transferable to other BRT in the metropolitan areas with similar system design and can serve as a reference for transit planners and engineers on the national level. **Research Objectives:** The main research objectives of this study are as follows: ➢ Communicate current and future needs related to the TSP system with UTA, Utah Department of Transportation (UDOT), and other interested parties (Wasatch Front Regional Council, cities and public); ➢ Define alternatives for TSP implementation with a focus on GPS-based TSP systems; ➢ Define approaches and modeling methodologies for alternative evaluation; ➢ Create, calibrate and validate microsimulation and other models to be used in analysis; ➢ Perform evaluations of alternatives that will include needs and inputs from all interested parties; ➢ Communicate the recommendations and define steps for system implementation; and Evaluate and quantify the benefits of TVM along the BRT, with emphasis on the direct benefit in dwell time and operational delay reduction.
Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	The first outcome of this study is complete sets of traffic and transit data collected under the existing conditions. The data is useful for planners, engineers and educators and can be used in potential future projects. The second outcome is the assessment of current traffic conditions for different transportation modes in the analyzed network. The developed microscopic simulation and traffic control software-in-the-loop can equip practitioners with a useful tool for detailed analysis of traffic control and TSP strategies in a high-fidelity simulation environment. The traffic models that emanate from this study can further be used for many other types of operational analysis. The third outcome of the project is the analytical procedure for measuring the

	benefits of TVM. The modeling approach is transferable to any transit route or system that is equipped with automatic passenger counters. The fare payment analysis can assist transit agencies with service optimization and performance assessments.
Impacts/Benefits of Implementation (actual, not anticipated)	The results from microscopic simulation show that GPS-based TSP performed as effectively as did traditional TSP. Conditional and multi-conditional TSP strategies showed benefits in providing the transit system considerable delay reduction and travel time savings while having the smallest impacts on side-street traffic compared with other TSP strategies. The modeling approach for dwell time and fare payment structure analysis can help unveil why dwell time under certain conditions (time of day, station, passenger population, etc.) is likely to persist. The results can be potentially useful to future BRT projects planning.
Web Links • Reports • Project Website	https://www.ugpti.org/resources/reports/details.php?id=908