MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 18-349 (project 469) | June 2018

Improving Efficiency and Reliability of Bus Rapid Transit

the **ISSUE**

Bus Rapid Transit (BRT) is an innovative, high-capacity, lower-cost public transit solution that can significantly improve mobility. BRT has the potential to significantly improve efficiency and reliability of public transit, which leads to an increase in ridership. Certain operational strategies significantly help BRT in improving travel times, speeds, and headway adherence, with the most benefits seen from the implementation of Transit Signal Priority (TSP) and off-board fare collection. Evaluation of these strategies can serve as a reference for transit planners and engineers on the national level.

the **RESEARCH**

This research focuses on the evaluation and analysis of two operational strategies for improving the efficiency and reliability of Bus Rapid Transit (BRT) system: Transit Signal Priority (TSP) and fare collection methods. The first objective is to evaluate the benefits and impacts of GPS-based TSP at the transit corridor level by using microscopic simulation. The test bed is the 3300 South corridor in Salt Lake County, Utah. The second objective of this study is to quantify the magnitude of advantages of off-board fare collection system along the existing 35M BRT line. This is achieved by determining the contributing factors of dwell time. This requires fare payment structure analysis which could be challenging due to the non-electronic fare media that do not have electronic footage. We propose a genetic algorithm based optimization method and regression model to disaggregate the individual contributions to dwell time of fare payment options, station placement, design, and the built environment.

MOUNTAIN-PLAINS CONSORTIUM REGION 8

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South Dakota State University
University of Colorado Denver
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University of Utah
Utah State University
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Improving Efficiency and Reliability of Bus Rapid Transit

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the **FINDINGS**

1. Eight simulation models are created to cover different combinations of transit operation patterns and TSP strategies. Outcomes are compared and analyzed to determine the relative changes in benefits and impacts on transit and non-transit traffic operations resulting from GPS-based TSP compared with other TSP strategies in both regular and rapid transit operation patterns.
2. The genetic algorithm based model to determine the contributing factors to dwell time demonstrated the advantage of off-board fare collection over on-board fare collection, with average boarding times of 5.2s, 1.8s, and 6.9s estimated for passengers using smart card, prepaid pass, and on-board cash payment, respectively. This further justifies the benefits of off-board fare collection system.

the **IMPACT**

1. 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.
2. 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.

For more information on this project, download the entire report at http://www.ugpti.org/resources/reports/details.php?id=908

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.

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