Project Information Form

Project Title	Performance Measurements of Transportation Systems based on Fine-Grained Data Collected by AVI and AVL Systems
University	Florida International University; University of Central Florida
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Total Project Cost	$506,719
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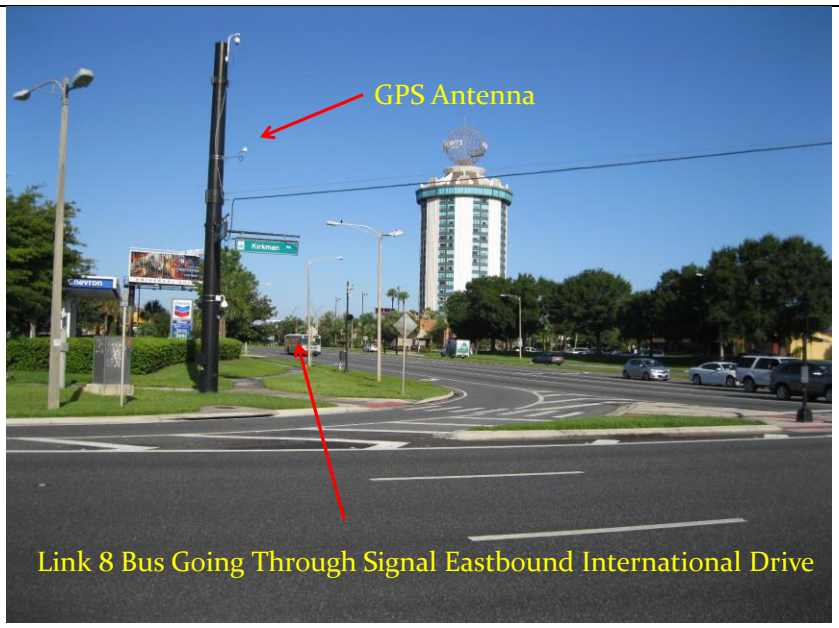
Start and End Dates	12/1/2014-5/31/2014
Brief Description of Research Project	Performance measurement is an important component of the planning and operation of transportation systems. Reflecting the increasing realization of this importance, the Map-21 legislation has put a very strong emphasis on performance measurements, requiring states and local agencies to establish and achieve performance targets. Point traffic detectors have been deployed along freeway facilities, providing mainly measurements of speed, volume, and occupancy. Automatic Vehicle Identification (AVI) technologies have also been increasingly implemented to directly collect travel time information rather than estimating them based on point measurements by traffic detectors. Transit agencies have used Automatic Vehicle Location (AVL) location technology to measure and manage the performance of their Fleets. The goal of this project is to investigate the opportunities for more detailed and accurate performance measurements of transportation systems based on point detectors, AVI, and AVL data.

	The differences between travel time estimates from detector data and AVI data (including Bluetooth data and electronic toll data) under different traffic conditions and different route lengths were examined in this project. Also, in order to determine the accuracy of disseminated instantaneous travel time information and thus the potential benefits of utilizing predictive travel time modeling, this study investigated the difference between instantaneous travel time and experienced travel time. Various methods were developed in this project to estimate queue length and density, including methods that are only based on traffic detector data, or only based on AVI data, or combination of different data sources. The developed methods were applied to the roadway segment along the Florida Turnpike using real-world data. Meanwhile, a microsimulation simulation model along the SR-826 was conducted to assess the estimation accuracy of each method. The project has examined free-flow speeds and their distributions along three corridors, including two freeway corridors (I-95 and Florida Turnpike) and one arterial street (US-1). The free-flow speeds for the I-95 corridor and US-1 were estimated based on the detector data and Bluetooth data, while the free-flow speeds along the Florida Turnpike were I-95 and US-1 were estimated from the detector and toll tag data due to the data availability. The results based on different estimation methods were compared to those obtained from the HCM method. The impacts of time-of-day, roadway grade, and horizontal curvature on free-flow speed were also examined. In addition, the possibility of estimating demand based on AVI data was examined in this study. The analysis presented in this study estimated the vehicle detection percentages that can be used as expansion factors to estimate volumes based on Bluetooth devices and point traffic detectors. The AVI data were also used to calculate peak hour factors (PHF). At the same time, the project is evaluating Transit Signal Priority (TSP) based on AVL data. The main goal of this research part of the project is to evaluate the benefits of TSP on transit operations in terms of: Improvement in bus travel time through International Drive, a real life corridor in Orlando, Florida, and bus adherence to schedule by reducing its travel time variability. Furthermore, this research will explore reduction in bus emissions which is expected to increase environmental sustainability. The research team has collected traffic data in the above corridor, and also collected “Before” and “After” TSP on-board bus data and signal pre-emption logs to determine if conditional TSP improves transit schedule reliability and adherence. The “Before” study has been

	completed, while the "After" study is in-progress. Statistical analysis and comparisons between "Before" and "After" conditions is also being conducted. The TSP effectiveness will also be evaluated using VISSIM simulation. Sensitivity analysis will be conducted using VISSIM. Several scenarios will be tested to optimize the amount of bus travel time delay that will trigger TSP. Signal operations and effect on crossing streets will be evaluated so as not to deteriorate operations for crossing street traffic while TSP is being implemented. This research is expected to have important impact on bus patrons of a real life transit corridor. With the help of TSP implementation in this real life corridor, it will be determined whether TSP provides more consistent travel times for the bus transit system in the International Drive corridor, can potentially increase bur ridership due to improvement in level of service, and increase environmental sustainability by reducing bus emissions in this tourists' corridor.
Describe Implementation of Research Outcomes (or why not implemented) (Attach Any Photos)	Results will be presented and discussed with FDOT, Florida Turnpike, Lynx, and City of Orlando. International Drive corridor has 16 Lynx buses and 7 traffic signals equipped with TSP. The City of Orlando preemption logs were reviewed in both unconditional and conditional states which verified that TSP was actually operational. Currently, conditional TSP only activates if the bus is at least 3 minutes behind schedule. VISSIM modeling will be performed to optimize this time in order to allow buses to adhere to their schedules and not affect traffic signal performance for traffic on crossing streets. Future TSP implementations will be located in downtown Orlando including the East West Lymmo project and the Parramore Bus Rapid Transit. Both will be TSP equipped feeder systems to the Sunrail commuter rail and will be operational in 2014.

TSP Opticom equipped traffic signal cabinet at Fun Spot in the International Drive corridor in Orlando, Florida; photo credit: Frank Consoli, City of Orlando

TSP GPS antenna at Fun Spot in Orlando, Florida, photo credit: Frank Consoli, City of Orlando



TSP equipped traffic signal at Kikrman road in Orlando, Florida, photo credit: Frank Consoli, City of Orlando

Link 8 Bus Going Through Signal Eastbound International Drive

TSP equipped bus on International Drive at Kirkman road, Orlando, Florida, photo credit: Frank Consoli, City of Orlando

	 TSP equipped buses at Lynx Link 8 and Central Station, Orlando, Fl, photo credit: Frank Consoli, City of Orlando With the expected positive outcome of this research, the system could be expanded to other area corridors.
Impacts/Benefits of Implementation (actual, not anticipated)	None yet.
Web Links • Reports • Project website	Draft final report was prepared.