New Jersey Department of Transportation
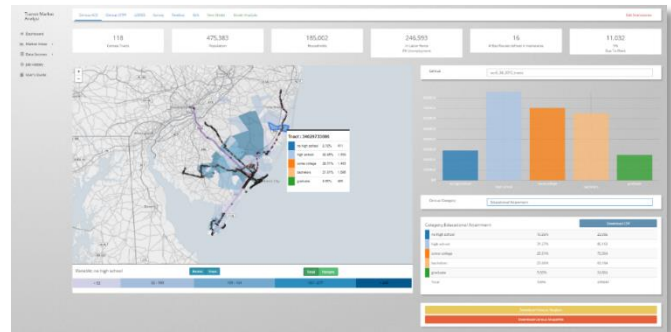## Bureau of Research

Technical Brief

Integration of Bus Stop Counts Data with Census Data for Improving Bus Service

This research project produced an open source transit market data visualization and analysis tool suite, The Bus Transit Market Analyst (BTMA), which contains user-friendly GIS mapping and data analytics tools, and state-of-the-art transit demand modeling microsimulation capabilities. BTMA combines both archived transit operations data (e.g., automatic fare-box data), and new open data resources, particularly GTFS and US Census.

Background

Providing a safe, efficient, and cost-effective bus network is a daunting challenge, requiring reliable data and high quality planning tools. Recent products made available by the United States Census Bureau, including the American Community 5-year Series and the 2010 decennial Census, create a golden opportunity for planners and researchers to refine the empirical basis for their population-based decisions. By delving into the demographics and characteristics of each of its markets, the New Jersey Department of Transportation (NJDOT) and New Jersey Transit (NJ TRANSIT) will better understand these characteristics, improving the lives of its stakeholders. NJDOT sought guidance from a qualified team of fellow researchers and planners to assist them in identifying the changing transit ridership trends present in the 2010 Census.

Research Objectives and Approach

Dr. Catherine Lawson's research team at the Albany Visualization And Informatics Lab (AVAIL), from the State University of New York at Albany, was tasked with developing and using web-based visualization software to analyze NJ TRANSIT ridership trends. AVAIL used a data science approach to conduct demographic, economic and transportation analytics for small-medium sized market areas in the state of New Jersey.

Findings

As a final product of this project, AVAIL developed a software tool suite called the Bus Transit Market Analyst. BTMA uses technology to aid in transit planning by mapping and visualizing various datasets and by developing demand models that put these data to work for the benefit of the State's people and economy. This demonstrates the commitment of NJDOT to achieve the tech-forward ideas set forth in its Long-Range Transportation plan and the Strategic Plan of the United States Department of Transportation (USDOT).

BTMA uses GTFS, a data standard for transit routes and schedules, to define market areas in a software full of dynamic maps and graphs. The software utilizes the new U.S. Census' American Community Survey (ACS) Application Programming Interface (API). This allows practitioners to immediately and automatically gain access to demographic information surrounding a transit route, by simply selecting a route and clicking on adjacent census tracks. Additionally, the tool offers market area analytics tools for Census Transportation Planning Products (CTPP) and Longitudinal Employer-Household Dynamics (LEHD), Longitudinal Origin-Destination Employment Statistics (LODES).

BTMA has a set of open source tools for analyzing and visualizing machine-readable automatic farebox data and ridership survey data. The survey tools include a set of interactive graphs and maps that allow users to filter by route, demographics, and customer data. BTMA also contains a state of the art microsimulation transit demand modeling tool that uses Open Trip Planner as a microsimulation routing "engine." With GTFS as a geo-spatial backbone, demographic information is used to generate origin/destination trip tables and are algorithmically plotted as "bus riders" throughout the market area census tracts. The bus riders are then microsimulated through Open Trip Planner.

All of the market area models underestimate full day ridership, despite often over-estimating peak-time ridership. This is expected due to the microsimulation model algorithm only accounting for work trips. It also points to how peak ridership behaves differently from market area to market area. Farebox data indicates fairly steady ridership throughout the day with a more concentrated AM Peak than PM Peak.

The final data visualization and informatics tool suite, is capable of offering an enhanced perspective on NJ TRANSIT's own transportation assets, is designed to identify the key demographic factors that influence transit ridership, assess the social, economic and systemic determinants that exist within the 2010 census, develop solutions that provide persistent competitive advantage for NJ TRANSIT, and provide the tools for continued success subsequent to the completion of this research project.

NJDOT Project Manager	Giri Venkiteela, Ph.D
	State of New Jersey Department of Transportation
	609-530-8038
	giri.venkiteela@dot.nj.gov
Principal Investigator	Dr. Catherine T. Lawson
	Albany Visualization and Informatics Lab, University at Albany, SUNY
	518-860-0438
	lawsonc@albany.edu

A final report is available online at: http://www.state.nj.us/transportation/refdata/research/

If you would like a copy of the full report, send an email to: Research.Bureau@dot.state.nj.us

Integration of Bus Stop Counts Data with Census Data for Improving Bus Service
NJDOT Research Report No: FHWA-NJ-2016-001