The Morgan State University National Center for Transportation Management, Research & Development Newsletter

The NTC Today

Fall 2018

Who owns electric vehicles and why?

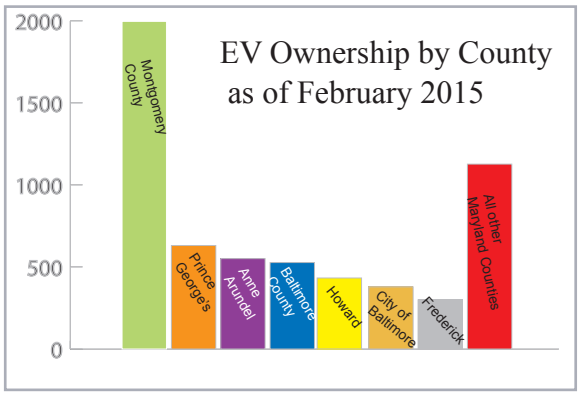
As the range of electric vehicles (EVs) improves – the 2018 Chevy Bolt can go 238 miles on a charge – they likely will become more mainstream. But who buys EVs and what do they look for when they do buy one? How will those factors influence policy to encourage a more widespread adoption of EVs?

Researchers at Morgan State University surveyed 1,257 registered owners of plug-in hybrid electric vehicles and battery electric vehicles in Maryland in summer 2016. The study, Environmental Attributes of Electric Vehicle Ownership and Commuting Behavior in Maryland: Public Policy and Equity Considerations, was funded by the Mid-Atlantic Transportation Sustainability University Transportation Center.

Researchers employed statistical analysis methods to analyze the data and examine the associations between EV owner characteristics and their reasons for purchasing an EV.

"This study was innovative in that it considered the socio-demographic factors and political affiliation to see how that related to EV ownership, and EV drivers' travel patterns," said Dr. Andrew Farkas, the principle investigator and director of the NTC. Political affiliation was a proxy for social networks of owners with similar socioeconomic and cultural attitudes.

He added, "The study also conducted a spatial analysis of commuting behavior and travel patterns. To the best of our knowledge, this is the first study



that comprehensively analyzed EV owners' travel behavior by geographic classification and compared the results to the behavior of conventional vehicle drivers."

The research revealed that age, household size, number of vehicles in the house, education, income and political factors influence EV ownership. EV owners tend to be white males who are more educated, affluent, older and more environmentally focused.

"Environmental issues are the main reason for EV owners purchasing or leasing an EV," said Amirreza Nickkar, one of the study's authors.

EVs were most popular among Democrats and least popular with those who are not interested in politics. Republicans who purchased EVs were more likely to consider price and status as reasons for buying one.

The large majority of EV owners with high household incomes, who are independent or Democrat, were more likely to have urban/suburban residences and employment locations, while EV owners with lower household incomes who are Republican tended to reside and work in exurban and rural locations. The analyses of travel patterns raised questions about the effectiveness of current EV incentive programs and charging locations.

"Owners use EVs for commuting to work but transit was not a significant mode choice, which means, for example, locating charging stations in employment clusters and along major commuting routes would be more effective than putting them at railway stations," Dr. Farkas said. "This research suggests providing financial incentives proportionally aimed more toward low- and medium-income households, and for previously owned vehicles, may increase EV market share."

Dr. Hyeon-Shic Shin, one of the authors, added, "While identifying earlier adopters for faster innovation is important, a more important task is to design policy alternatives to attract potential adopters with less purchasing power, since the price is a significant barrier to vehicle purchase."

Dr. Shin added, "Easy access to charging stations where EV demand is clustered would be a more reasonable way to promote EV adoption." •

A Message from the NTC Director

DR. ANDREW FARKAS

This edition of the NTC newsletter reports on activities supported by our three USDOT University Transportation Center grants, including those of the Urban Mobility & Equity Center.

We feature a completed research project that focused on electric vehicle owners in Maryland, particularly their purchasing and commuting behavior, but also note several projects by us and our partners that foster transportation innovation and enhance mobility. We also have been active in workforce development, introducing transportation to middle and high school students and their teachers.

While these activities will pay off in the future, particularly because we emphasize implementation and technology transfer, I'm pleased to note that Morgan State and the local transit system are undertaking immediate enhancements of urban mobility "on the ground."

First, the Maryland Transit Administration has constructed a bus pull-over on Hillen Road near the Northwood Shopping Center and the School of Business as an end-of-the-line layover. This layover is for the Silver Line that connects Morgan State to downtown and finally to Curtis Bay, south of Baltimore.

Second, the university has recently announced and revealed a rendering of Northwood Commons, a nearby redevelopment of the current partially vacant Northwood Shopping Center, which will contain the university bookstore, restaurants, and coffee shop. The redevelopment will serve not only Morgan State students but the surrounding community by bringing retail shopping and recreational opportunities to the people. Enhancing mobility for those that are transit or ride-share dependent and successful redevelopments with community buy-in often create synergy for improving the urban built environment. More research is key to understanding how these projects can be successful and beneficial.

After looking over this issue, please give us your thoughts about our progress. •

About the Center

The National Transportation Center (NTC) at Morgan State University is committed to transportation research and education that support the well-being and economic development of communities. It is home to the Urban Mobility & Equity Center, a Tier 1 University Transportation Center.

Staff

Dr. Andrew Farkas
Director

Anita Jones
Project Planner

Nancy Jackson
Editor

Valencia Baker
Education Coordinator

Sonia McDonald
Secretary

Contact Information

National Transportation Center
Morgan State University
1700 E. Cold Spring Lane
CBEIS 327
Baltimore, MD 21251
www.morgan.edu/soe/ntc
Phone: 443-885-3666
facebook.com/morganntc
@NTCMorgan
Instagram: ntcumec

Comments?

nancy.jackson@morgan.edu

SHA Interns
Tamiah Griffin
George Smith
Elizabeth Olusola
Tamara Beach

MDOT-MSU Interns
Chibuike Nosiri
Danny Brown
Esther Ogunlade
Joseph Bateky
Jami Mensha
Gary Charles
Kelechi Uradu
Michael Awotoye
Michael Cassell
Mohammadreza Jabehdari
Olatunji Dipeolu
Oluwafemi Ebilakun
Snehanshu Banerjee
Obinna Obika
Olutayo Ojo
Oluwatoni Samagbeyi
Sha'Von Terrell
Tolawase Ayanleke
Kehinde Adenuga
Olalekan Asaolu
Tolulope Ajayi
Chinwe Ihuoma
Priscilla Nartey

CATT Lab

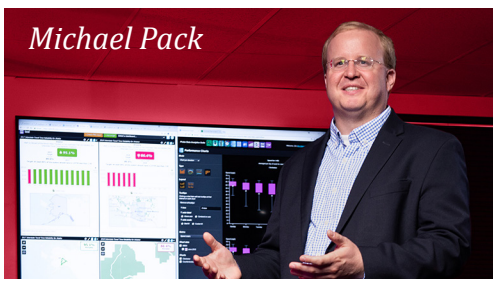
Researchers handle some 7.5 million measurements daily

The little red cars that signal a backup appear on WAZE, a community-based traffic and navigation app. In another state, a police car and ambulance are dispatched to the scene of an accident. A sensor in a highway picks up that traffic is moving well above the speed limit.

All of that data and much more – about 7.5 billion measurements per day –flow to the Center for Advanced Transportation Technology (CATT) lab at the University of Maryland, where it is archived.

The University of Maryland partners with Morgan State University for transportation research and is a member of the Urban Mobility & Equity Center, a Tier 1 University Transportation Center led by Morgan.

Michael L. Pack, director of the CATT lab, says the lab maintains three separate data centers and powers hundreds of servers to handle the several hundred data feeds flowing into CATT.


Michael Pack

"Our mission is to go and grab data from any agency or company that has transportation data," Pack says, adding that the data is in real time. "We suck data from state departments of transportation and traffic management systems, and from computer-aided dispatch like police and fire, sensors in roadways, cameras and probe vehicles. We can tally what the speed is on pretty much any road in the country."

The data is used to establish priorities, such as locations with a high number of crashes or where the worst congestion is occurring. The data helps quantify that congestion information in terms of its cost, in both economic and personal impacts.

"We have tools to look at a state's data and help them decide where they should invest their limited dollars," Pack said.

The CATT center – which has 40 full-time software developers, programmers and artists, aided by 30 to 60 undergraduate and graduate students – is best known for its Regional Integrated Transportation Information System (RITIS) platform. The platform, which gives access to all the data sets, allows CATT to coordinate data operations, address planned events and detect anomalies. CATT employees can notify the appropriate agency if they see that something unusual is occurring.

One project, the probe data analytics suite, with tools like bottleneck ranking, takes billions of measurements from cell phones and GPS probes to find the most congested locations nationwide. CATT lab data also can establish if implemented solutions actually work.

Funded by private sector investment and contracts with 33 state DOTS, the CATT lab focuses mostly on surface transportation. It was founded in 2002 to solve pressing transportation problems by using data.

But data, of course, is only useful if it can be easily retrieved and understood.

"How can you represent huge datasets that are larger than what you could fit on screens?" Pack asks.

Data visualization takes research beyond tables, maps or spreadsheets and makes it more accessible with pictures and graphics. Thanks to retrieval tools, planners can log in and ask for information, and an easy-to-understand report can be generated instantly.

"Taking data and fusing and visualizing it – that is our primary research," Pack said.

To learn more, visit www.cattlab.umd.edu •

Ongoing Research Projects

Improving the Reliability of Freight Transportation
Dr. Paul Schonfeld (University of Maryland), Dr. George List (North Carolina State University), ***Dr. Hyeon-Shic Shin***

Eco-Speed Control for Hybrid Electric Vehicles and Buses in the Vicinity of Signalized Intersections
Dr. Hesham Rakha (Virginia Tech), ***Dr. Mansoureh Jeihani***, ***Dr. Celeste Chavis****, Dr. Hai Chen (Virginia Tech)*

Multi-layered Integrated Urban Freight Delivery Network – Phase I: Identification of Policy Preferences based on Qualitative and Conjoint Analysis
Dr. Hyeon-Shic Shin, ***Dr. Michael Callow***

Improving the Reliability of Freight Transportation
Dr. Paul Schonfeld (University of Maryland), Dr. George List (North Carolina State University), ***Dr. Hyeon-Shic Shin***

"Hands on the Wheel, Eyes on the Road" Campaign
Dr. Mansoureh Jeihani

Understanding Access to Grocery Stores in Food Deserts in Baltimore City
Dr. Celeste Chavis, Anita Jones

Innovative Methods for Delivering Fresh Foods to Underserved Populations
Dr. Hyeon-Shic Shin, Dr. Young-Jae Lee, *Dr. Paul Schonfeld (University of Maryland*

Developing a Connected Vehicle Transit Signal Priority System
Dr. Kyoungho Ahn (Virginia Tech), Dr. Hesham Rakha (Virginia Tech), ***Dr. Young-Jae Lee***

Developing and Testing an ECO-Cooperative Adaptive Cruise Control System for Buses
Dr. Hesham Rakha (Virginia Tech), Hao Chen (Virginia Tech), ***Dr. Mansoureh Jeihani***

Optimization of Emergency Traffice Patrols (ETP) Operations
Dr. Ali Haghani (University of Maryland), ***Dr. Mansoureh Jeihani***

Dynamic Vehicle Routing with Route Guidance for Urban Pickup and Delivery
Dr. Ali Haghani (University of Maryland)

Optimized Development of Urban Transportation Networks
Dr. Paul Schonfeld (University of Maryland)

Optimizing Small-Sized Automated Transit Operations and Its Applications
Dr. Young-Jae Lee

Development of Multimodal Traffic Signal Control
Dr. Hesham Rakha (Virginia Tech), Dr. Kyoungho Ahn, Virginia Tech

Traffic State Prediction: A Traveler Equity and Multi-model Perspective
Dr. Hesham Rakha (Virginia Tech)

Evaluating Equity Issues for Managed Lanes: Methods for Analysis and Empirical Results
Dr. Cinzia Cirillo (University of Maryland)

New Research Projects

Sustainable Design of Concrete Bus Pads to Improve Mobility in Baltimore City
Dr. Mehdi Shokouhian

Managing the Impacts of Different CV/AV Penetration Rates on Recurrent Freeway Congestion From the Perspective of Traffic Management
Dr. Gang-Len Chang (University of Maryland)

Driver's Interactions with Advanced Vehicles in Various Traffic Mixes and Flows (autonomous and connected vehciles, (ACVs) electric vehicles (EVs) V2x, trucks bicycles and pedeatrians) - Phase I: Driver Behaviro Study and Parameter Estimation
Dr. Mansoureh Jeihani

Climate Change & Non-Motorized Transport
Dr. Ardeshir Faghri (University of Delaware), ***Dr. Hyeon-Shic Shin***

Shared Bus-Bike Lane Safety Analysis: Assessing Multimodal Access and Conflicts
Dr. Celeste Chavis, *Dr. Cinzia Cirillo (University of Maryland)*

Developing an Eco-Cooperative Adaptive Cruise Control System for Electric Vehicles
Dr. Hesham Rakha (Virginia Tech), Dr. Cinzia Cirillo (University of Maryland)

E^3: Evaluating Equity in Evacuation: A Practical Tool and Two Case Studies
Dr. Cinzia Cirillo (University of Maryland)

Improving Public School Bus Operations: Boston Case Study
Dr. Youssef Bichiou (Virginia Tech), Dr. Hesham Rakha (Virginia Tech), ***Dr. Young-Jae Lee***

Final reports for completed projects are available on our website at
www.morgan.edu/soe/ntc

2018 Completed Research Projects

Impact of Level of Service (LOS) on the Driver's Behavior on Arterials
Dr. Behzad Aghdashi (North Carolina State University), ***Dr. Celeste Chavis***, ***Dr. Mansoureh Jeihani***, *Sangkey Kim*

Quantifying the Impact of On-Street Parking Information on Congestion Mitigation
Dr. Celeste Chavis, ***Dr. Mansoureh Jeihani***, *Dr. Hesham Rakha (Virginia Tech)*

Connected Vehicle Technologies for Energy Efficient Urban Transportation
Dr. Ajay Prasad (University of Delaware), Dr. Suresh Advani (University of Delaware), ***Dr. Hyeon-Shic Shin***

Inlet Cleaning Pollutant Characterization Study for Total Maximum Daily Load (TMDL) Compliance
Dr. James G. Hunter, ***Dr. Dong Hee Kang***, *Dr. Neely Law (Center for Watershed Protection), Bill Stack (Center for Watershed Protection)*

Bicycle Justice or Just Bicycles: Analyzing Equitable Access to Baltimore's Bike Sharing Program
Dr. Celeste Chavis, *Dr. Philip Barnes (University of Delaware), Susan Grasso (University of Delaware),* **Istiak Bhuyan**, **Amirreza Nickkar**

Environmental Attributes of Electric Vehicle Ownership and Commuting Behavior in Maryland: Public Policy and Equity Considerations
Dr. Andrew Farkas, Dr. Hyeon-Shic Shin, Amirreza Nickkar

Potential Effects of Composition and Structure of Dynamic Message Sign (DMS) Messages on Driver Behavior and Their Decision to Use Freeway Incident Traffic Management (FITM) Routes
Dr. Mansoureh Jeihani

Students, teachers find unexpected fun in transportation

Zishan Vahora, a Perry Hall Middle School student, illustrates just how summer programs contribute to workforce development.

He signed up for the Middle School Summer Transportation Initiative (MSSTI) to have fun. But Zishan, who hopes to be a software engineer one day, became interested in the difference between types of bridges, especially suspension bridges and cable bridges.

"I kind of like it," he says.

Pharaoh Myers, a rising eighth-grader at Kippujima Village, was already interested in transportation and eagerly embraced learning the terminology so that he could talk to people in the field.

"It's like a different way of speaking," he said.

MSSTI, in its second year, is patterned after the Summer Transportation Institute (STI), a program for high school students now in its 22nd year. MSSTI hosted 15 students. Both

Teachers studied roudabouts, visited area roundabouts and then designed one of their own.

programs are free and sponsored by Morgan State University's National Transportation Center and Urban Mobility & Equity Center with funding from the Federal Highway Administration and the Maryland Department of Transportation State Highway Administration.

Twenty students took part in STI this year, and the theme was aviation. Field trips included aviation museums, the University of Maryland Eastern Shore, which has a flight simulator, and the University of Maryland, which has a wind tunnel. During their final presentations, several students said

STI students focused on aviation; on a trip to Glenn L. Martin Airport, they investigated different aircraft.

their experiences prompted them to change their career focus to aviation.

Sa' Raye Wynder-Burs, a senior at Woodbridge High School in Virginia, was thinking of being an editorial assistant and majoring in literature, "but now I've been researching being an aviation technical writer, writing instructions for the planes," she said. "I have a lot more to think about than before I came here."

Ike Nwadeyi, a 10th-grader at Parkville High School, was interested in being a defense attorney but is now thinking about aeronautical engineering.

Fellow Parkville student Jalen Wright wasn't quite sure what he wanted to do, but after seeing the wind tunnel, he wants to attend the University of Maryland and major in aerospace engineering.

"One thing this program has taught me is if you want something, you have to work hard at it," he said.

Gerald Akwuole, also from Parkville, wants to be a nuclear physicist. He drew a laugh during a presentation when he admitted, "I did not look at the instructions carefully when constructing my Delta Dart plane, causing my plant to not operate as I wanted it to. I need to read the instructions more carefully, especially if I go into nuclear physics because if I don't – boom."

Teachers get in on the fun.

The Teacher Transportation Institute (TTI), a two-week free program, helps teachers understand science, technology, engineering and math (STEM) concepts in the context of transportation by studying and then creating roundabouts.

Continued on page 7

Summer programs open up possibilities

Continued from page 6

"I had no idea there were that many careers in transportation," said Robert Henderson, who teaches computer technology at Digital Harbor High School.

Vernal Harrell, who teaches at Eager Street Academy, thinks creating a roundabout and using an engineering ruler and measurements will reinforce geometry and algebra for her students.

"This is another way they're not always in the book," she says. "They have a hands-on activity. She noted that the texture of the materials used to build the roundabout, such as grass and cars, would work well for visually impaired students.

Visting a Coast Guard station inspired a few students to consider the Coast Guard as a future career choice.

Guest speaker Ricky Smith, executive director of the Maryland Aviation Administration.

Alfred Lloyd, who teaches A+ certification at Digital Harbor High School, says A+ is part of networking "and in networking you have a binary - you have to use a different scale and unit, and it's the same thing with the engineering ruler." He also notes that connected vehicles use wireless technology "and that falls right in with that A+."

All three programs concluded with a banquet on July 27, 2018, and Ricky D. Smith Sr., the executive director of the Maryland Department of Transportation Aviation Administration, was the keynote speaker.

Smith's life story was fascinating; he grew up in Reservoir Hill on Whitelock Street, and a basketball scholarship took him to Virginia Union in Richmond. But when his coach wanted him to focus solely on basketball and major in phys ed, Smith, who dreamed of being an accountant, returned home and struggled to attend Howard University. One semester he was even homeless but he perservered. One of his biggest challenges, though, was adapting to the wider world, and it started when he went to work at Baltimore Washington Thurgood Marshall Airport.

"Whitelock Street, Virginia Union, Howard – everybody looked like me," Smith said. "I went to the airport and nobody looked like me. It was culture shock. I had to figure out how to adapt. You will find yourselves in situations where you have to adapt. I didn't lose myself – I'm still from Whitelock Street, but some of those people who didn't look like me saw something in me ... that was my path. Each one of us has our own path. It's not your friend's path, it's not your buddy's path, it's not Michael Jordan's path – it's your own path."

Dr. Andrew Farkas, the director of both the National Transportation Center and the Urban Mobility & Equity Center, said, "This was the first year that we've run all three programs, which meant more work for us, but I think we've influenced more people to be engaged in transportation. We hope our students and the students impacted by the teachers in our program will consider a career in transportation, but at least they will be more informed about all that transportation does for the economy and this region."•

Middle school students focused on bridges and bridge construction and made presentations during the program, which exposes students to transportation at an earlier age.

Research conducted here reaches a wider audience

Dr. Mansoureh Jeihani and graduate student Zohreh Rashidi Moghaddam have filed an intellectual property disclosure form with the Office of Technology Transfer for a software-oriented interface they developed.

Dr. Jeihani has received another MDOT-MHSO grant for the research project "Investigating the Impact of Distracted Driving among Different Socio-Demographic Groups," Maryland Department of transportation (MDOT), October 2018-September 2019.

She and her graduate students are well represented in publications:

- Banerjee, S., Jeihani, M., and RashidiMoghaddam, Z., "Impact of Mobile Work Zone Barriers on Driving Behavior on Arterial Roads," which has been accepted by the Journal of Traffic and Logistics Engineering.
- Ahangari, A., Chavis, C., Jeihani, M., RashidiMoghaddam, Z. "Quantifying the Impact of On-Street Parking Information on Congestion Mitigation Using a Driving Simulator," Transportation Research Record: Journal of the Transportation Research Board, No. 3969, 2018.

Graduate students Snehanshu Banerjee and Nashid Khadem were selected as the second place winner of the 2018 Excellence in Highway Safety Data Award Competition for the paper "Factors Influencing Injury Severity in Alcohol-Related Crashes: A Neural Network Approach Using HSIS Crash Data." As part of the award, they received $500 and attended the 2018 Joint ITE International and Midwestern/ Great Lakes Districts Annual Meeting and Exhibition in August 2018.

- Banerjee also presented two papers, accepted for the Journal of Traffic & Logistics Engineering, at the International Conference on Intelligent Traffic Transportation in Sweden in September.
- "Impact of Work Zone Signage on Driver Speeding Behavior: A Driving Simulator Study Invited Student Paper," by Banerjee, Duwan Morris, Nashid K. Khadem and Dr. Jeihani, will be presented at the 2019 Transportation Research Board Annual Meeting.

Dr. Mehdi Shokoukian has received a research grant from the Mid-Atlantic Center for Integrated Asset Management for Multi-Modal Transportation Infrastructure Systems (CIAMTIS). He also is an author in the following publications:

- Ntonifor C., Shokouhian M., Head M., Investigation of the Ductility of Non-Prismatic Hybrid High Strength Steel Beam-Columns (Accepted), Structures Congress April 25-27, 2019.
- Alanazi A., Upton G., Shokouhian M., Head M., Experimental Investigation of Residual Compressive Strength of Partially Confined Concrete Column Retrofitted Using CFRP Wrap (Accepted), Structures Congress, April 25-27, 2019, Orlando, Florida.
- Grose S., Shokouhian M., Head M., Nonlinear Analysis of AFRP Connections of Reinforced Concrete Bridge Decks, Structures Congress, April 18-21, 2018.
- Efe S., Shokouhian M., Head M., Numerical Analysis of AFRP Reinforced Concrete Columns with Replaceable Structural Fuses as Energy Dissipaters under Cyclic Loading, Structures Congress, April 18-21, 2018, Fort Worth, Texas.

Ph.D. student Amirreza Nickkar won second place for the paper "Effects of Demand Variation on Optimal Automated Demand Responsive Feeder Transit System Operation in Rural Areas," submitted for the 23rd National Conference on Rural Public & Intercity Bus Transportation. The award included a trip to the conference in Breckenridge, Colorado.

Dr. Celeste Chavis received a DDOT grant of $92,106 for the project Analysis of Bicycle and Pedstrian Crash Causes and Interventions. She also has been appointed to the board of the Central Maryland Transportation Alliance. •

Above left, the Second Annual Transportation Summit was held in April. Above right, Nashid Khadem (left) and Snehanshu Banerjee (center) received second place for their research.