UNIVERSITY OF MARYLAND

Connecting the dots: **transportation, the environment, and equity.**

MARYLAND TRANSPORTATION INSTITUTE

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Maryland Transportation Institute
ANNUAL REPORT 2020-21

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DIRECTOR'S MESSAGE

We live in times that are both troubling and exciting. Troubling, because we face environmental hazards—notably, those associated with climate change—that are not only daunting in and of themselves, but also test the ability of society to respond to them. Exciting, because we have at our fingertips tools and methodologies that can help us understand these challenges and devise practical solutions.

Consider the Chesapeake Bay, for example. Toxins found in vehicle emissions, as well as leaked fuel and fluids, flush into stormwater entering the Bay, endangering its ecosystems and impairing water quality. It's not an easy problem to solve, but we're making progress. Recent years have seen burgeoning interest in the use of green infrastructure, including vegetation and compost, as a means to contain stormwater and reduce the seepage of toxins into the Bay. As you'll learn in our Research Spotlight, MTI affiliates Ahmet Aydilek and Allen Davis have been leading a series of studies—including several funded by the Maryland Department of Transportation's State Highway Administration—that explore these methods and assess their performance.

The health of the Chesapeake affects communities that depend on its waters for a livelihood. On Maryland's Eastern Shore, sandwiched between the Chesapeake Bay and the Atlantic, residents of low-lying communities face rising sea levels with increased flooding. Transportation engineers must assist communities in evaluating the risks and determining the best way to adapt—for example, by raising roads and building levees. MTI affiliate Allison Reilly and doctoral student Zeinab Jasour have been developing models to help communities plan for the effects of rising sea levels.

Environmental issues inextricably connect with issues of equity. For example, when policy decisions shortchange public transportation, these decisions not only have an environmental impact, but also create barriers for lower-income people. Historically, decisions on transportation infrastructure often exacerbated socioeconomic inequities. As UMD Associate Professor Sacoby Wilson notes, when a decision is made to route a highway through a neighborhood—as has often happened with many predominantly Black communities—the residents

are doubly harmed: not only does the new infrastructure fragment the neighborhood, but it exposes the residents to dangerous toxins. Increasing access for low-income populations while also ensuring sustainability is a major area of interest for the Urban Mobility and Equity Center (UMEC), an MTI affiliated research hub based at Morgan State University. Since its inception, UMEC has supported dozens of projects that explore practical solutions to environmental and equity issues. In one, UMD Professor Cinzia Cirillo is monitoring the results of an experiment in Northern Virginia designed to incentivize use of public transportation by offering free fares.

The above examples reflect the breadth and diversity of transportation research being conducted across multiple institutions under the MTI umbrella. Because environmental and socioeconomic challenges are complex, involving many variables, addressing them requires a combination of top-drawer expertise and advanced tools and methods, including data analytics. That is the edge that we at MTI have to offer.

With best regards,

Deb Niemeier
CLARK DISTINGUISHED CHAIR OF CIVIL AND ENVIRONMENTAL ENGINEERING, UNIVERSITY OF MARYLAND
ACTING DIRECTOR, MARYLAND TRANSPORTATION INSTITUTE

A SERIES OF FIELD TEST SECTIONS WILL BE CONSTRUCTED AT THE MNROAD FACILITY, ONE OF THE LARGEST OUTDOOR PAVEMENT RESEARCH LABORATORIES IN THE WORLD.

Environmental stewardship in transportation networks

Transportation requires infrastructure. From highway and rail networks to airports and ports, the physical infrastructure that we depend on for movement of goods and people has unwanted environmental consequences, including excess stormwater production and impaired water quality.

RESEARCH LED BY MTI AFFILIATES AYDILEK AND DAVIS HELPS REIN IN STORMWATER-RELATED HAZARDS THROUGH THE USE OF VEGETATION AND COMPOST.

And infrastructure is only part of the problem. Moving vehicles are the source of many urban pollutants. Internal combustion engines release emissions, including nitrogen oxide compounds that return to the earth's surface. Tires, brakes, and other vehicle components are designed to wear with use; fuels and lubricating fluids will spill and leak.

The flow of pollutants poses an ongoing threat to Maryland's Chesapeake Bay, given that the Bay and its tributaries are the receiving points of stormwater. Indeed, many of Maryland's water bodies have been designated as impaired and are being regulated with Total Maximum Daily Load (TMDL) restrictions and requirements.

And Maryland is hardly alone. Most, if not all, U.S. State Departments of Transportation have local waste load allocations to comply with TMDLs. Other jurisdictions with allocations target their transportation networks for TMDL compliance.

In an ongoing effort to develop practical, long-term solutions, two UMD professors and MTI affiliates—Ahmet Aydilek and Allen P. Davis—have been conducting multiple projects that cover various facets of the stormwater puzzle. The two professors are co-principal investigators (PI) on several projects funded by various state and federal transportation agencies, including the Maryland Department of Transportation – State Highway Administration (MDOT SHA), with the aim of developing practical, long-term solutions to the environmental problems associated with transportation networks.

These projects include several collaborators: Prof. Gary Felton of the UMD Department of Environmental Science and Technology (ENST), Prof. John Lea-Cox of the UMD Department of Plant Sciences and Landscape Architecture (PSLA), Dr. Andrew Ristvey of UMD Extension (UME), and Prof. Bora Cetin of Michigan State University.

GREEN INFRASTRUCTURE: THE PROMISE AND THE CHALLENGE

Stormwater TMDL compliance frequently necessitates the use of novel stormwater control measures (SCMs). Green infrastructure SCMs such as bioretention, vegetated swales and filter strips, stormwater wetlands, green roofs, and others are being promoted as effective technologies for stormwater volume and pollutant load reductions.

But green infrastructure SCMs are complex systems that operate under highly dynamic conditions. Most have a media component as well as vegetation. A large list of pollutants must be targeted in SCM research; water body impairments in Maryland and throughout the U.S. include nutrients, as in the case of the Chesapeake Bay, as well as heavy metals, bacteria, trash, and many toxic organics.

"Green infrastructure SCMs will provide stormwater benefits but may offer other benefits that can be quantified as well, including ecological habitats, social benefits from green space, and reduction in heat island effects," Davis said.

In addition to stormwater, several geoenvironmental research challenges relate to various materials formed or used in transportation networks. Following large-scale transportation infrastructure construction projects, miles of land are left unvegetated and exposed to erosive rainfall. Rapid vegetative establishment and growth is required to minimize soil erosion and wash-off of soil and nutrients.

"Research on best practices for minimizing erosion and nutrient leaching is needed," Aydilek said. "Although the use of chemical or natural fertilizers—such as compost, biochars, and similar nutrient-rich materials—may benefit vegetative growth, it can lead to leaching of nutrients. Environmental, geotechnical, and other properties must be considered for beneficial use of these materials."

ASSISTING MDOT SHA

The research being conducted by Aydilek, Davis, and their collaborators has direct relevance to the state of Maryland and includes several projects commissioned by MDOT SHA as it explores new ways to control the environmental risks associated with transportation infrastructure.

(CONT. ON PAGE 4)

PHOTO: ERICA FORGIONE

UMD CIVIL AND ENGINEERING PH.D. STUDENT LIANG LIANG (NOW GRADUATED) TAKES A CORE SAMPLE OF SOIL AND COMPOST FROM A VEGETATIVE COMPOST BLANKET (VCB) DURING A POST-INSTALLATION ASSESSMENT ON MD ROUTE 32 NEAR ITS INTERSECTION WITH INTERSTATE 95 IN HOWARD COUNTY, MARYLAND. VCBS ARE BEING STUDIED AS A STORMWATER CONTROL MEASURE (SCM) WITH THE POTENTIAL TO REDUCE AND CLEAN POLLUTED HIGHWAY STORMWATER RUNOFF.

(CONT. FROM PAGE 3)

Which compost products work best? In two MDOT SHA-sponsored projects ("Use of Compost for Permanent Vegetation Establishment" and "Erosion Control and Understanding the Effects of Slope Ratio, Straw Mulching, and Compost Addition to Topsoil to Establish Permanent Vegetation and Reduce Nutrient Runoff"), the two UMD professors worked with Graduate Research Assistant Dylan Owen to evaluate the performance of select compost products in establishing permanent vegetation for preventing construction site erosion and reducing sediment and nutrients release in transportation networks.

Two compost types—biosolids and greenwaste—and topsoil-compost blends were compared with the standard topsoil, straw coverage, and fertilizer in order to gauge their ability to reduce soil loss and improve the rate, quality, and quantity of vegetation establishment. Comparisons for vegetation establishment with and without straw mulching showed a significant increase in establishment rates for all tested media (4- to 33-fold faster). In addition, the research team showed that biosolids application was the most successful at total runoff volume reduction while greenwaste performed similarly to topsoil.

Better understanding properties that affect vegetation establishment In an ongoing study, Aydilek and Davis are collaborating with UMD College of Agriculture and Natural Resources faculty members John Lea-Cox and Andrew Ristvey, together with Graduate Research Assistants Jennifer Morash and Sai Pamuru, on greenhouse-scale tests designed to provide science-based information on geotechnical properties, water infiltration and retention, nutrient availability, and leaching properties that affect vegetation establishment and growth characteristics for Maryland composts and blends using materials common to MDOT SHA projects. This information will allow MDOT SHA to specify the utilization of compost (and other forms of organic amendments) in highway construction projects to minimize environmental impacts. The information on compost performance obtained from this project will facilitate increased use of compost materials for improved functionality of compost-amended topsoil blends in highway embankment stabilization, without leading to excess environmental or management impacts.

The study supports compliance with Maryland House Bill 878, which requires the use of compost and compost products in soil erosion and sediment control practices in MDOT SHA construction projects. Moreover, a comparative greenhouse evaluation of the compost-based products and traditional erosion prevention and control measures, e.g., topsoil, will be available to MDOT SHA engineers and landscapers.

PHOTO: DYLAN OWEN

UMD STUDENTS (NOW GRADUATED) TIM BLOUNT (LEFT) AND MOISES UMANZOR (RIGHT) COLLECT VEGETATION BIOMASS AT ONE OF TWO FIELD LOCATIONS WHERE FIVE UNIQUE SOIL EROSION CONTROL MEASURES WERE TESTED FOR THEIR ABILITY TO IMPROVE VEGETATION ESTABLISHMENT AND REDUCE SOIL, NUTRIENT, AND VOLUME RUNOFF.

Evaluating highway embankments With sponsorship from MDOT SHA, Aydilek, Davis, and Graduate Research Assistant Amanda O'Shaughnessy are evaluating the application of the United States Department of Agriculture (USDA) Natural Resources Conservation (NRCS) Maryland Conservation Practice Standard Code 378 to highway embankments that may pond water. These embankments represent a current gray area of regulatory application and may be classified as dams under Maryland regulatory guidance under consideration. However, highway embankment design and dam design requirements are very different and have mutually exclusive design components.

As MDOT SHA looks to future highway expansion projects and considers flooding risks due to climate change, this research will help it better understand the performance, failure rates, failure modes, and inspection frequencies of Code 378 ponds located in the mid-Atlantic region. It will also provide information on what other approaches should be incorporated into the upcoming Code 378 revisions.

ADDITIONAL RESEARCH PROJECTS

In addition to projects with a specific focus on Maryland, Aydilek and Davis are collaborating on several other research endeavors that explore the use of compost in stormwater control.

Using compost to control stormwater In a project funded by the National Cooperative Highway Research Program, Aydilek and Davis are joined by UMD Environmental Science Professor Gary Felton and Graduate Research Assistant Erica Forgione in examining a potential stormwater control measure called a vegetated compost blanket. This consists of a layer of compost loosely applied over existing highway medians and then seeded, with the intent of mitigating hydrologic and water quality issues associated with highway stormwater runoff. The project will provide design guidance to state DOTs for an effective and economical best management practice that can be used in various roadway settings.

Evaluating soil amendments Aydilek and Davis are collaborating with Bora Cetin of Michigan State University on a Minnesota Department of Transportation (MnDOT) study that evaluates several proprietary soil amendments for use in stormwater management control. The research study, which includes field tests at the MnRoad facility—one of the largest outdoor pavement research laboratories in the world—will deliver a guideline and tool for selecting the optimum mixing ratios for compost and proprietary soil additives. The guideline and tool will provide the most cost-effective material selections to establish vegetation on the roadside after construction is completed.

Measuring improvement As part of a new project sponsored by the Iowa Department of Transportation, Aydilek, Davis, and Cetin will quantify the improvements for vegetative establishment and subsequent stormwater volume reduction and study rapid restoration of roadside soil quality by composts, proprietary soil amendments, and biochars. The same study will also investigate the impact of soil compaction and tillage effects on roadside soil quality restoration and involves developing a specification and implementable guidance for these restoration techniques through a series of field and large-scale laboratory tests.

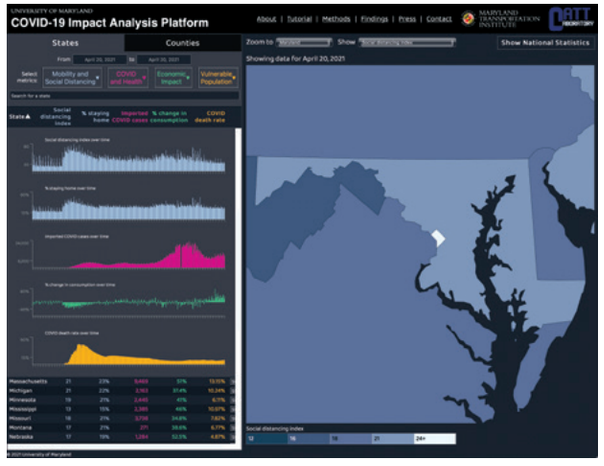
Gaining an edge on **infectious diseases**

A multi-institutional project focuses on using mobile phone data to model mobility behavior and anticipate public health risks.

In theory, developing models of the way people get around can help greatly in tracking the spread of infectious diseases—and containing outbreaks before they happen. But modeling efforts have, until recently, been hampered by a lack of sufficient data.

The Federal Highway Administration's (FHWA) most recent National Household Travel Survey (NHTS), for instance, was conducted in 2017, years before the COVID-19 pandemic. "In general, we've had to rely on data that is not collected very often and samples a relatively low percentage of the population," notes MTI Assistant Director Chenfeng Xiong, who holds joint faculty appointments with the University of Maryland's civil and environmental engineering department and the Center for Shock Trauma and Anesthesiology Research at the University of Baltimore (UMB).

Backed by a grant from the National Institutes of Health (NIH), Xiong is collaborating with UMB infectious disease expert Meagan Fitzpatrick and other colleagues in a multi-institutional effort aimed at creating more effective models through the use of new technology. The team will be using data gleaned from mobile devices, such as cell phones, to track mobility behavior continuously and in near real-time, allowing them to better connect the dots between travel and public health. The mobility models will then be linked to dynamic infectious disease models, in order to capture how human mobility influences infectious disease transmission at different locations.



As Xiong explains, "technological advances have given us a great opportunity to improve our understanding of the risks from infectious diseases, particularly as these risks are linked to mobility behavior."

At the heart of the project is a massive, real-time database developed by MTI in support of an upgraded NHTS, and utilized during the COVID-19 pandemic to stand up a COVID-19 Impact Analysis Platform that tracked social distancing compliance, impacts on the economy, and other variables.

The MTI database pulls in individual smartphone location data and covers around 60% of the U.S. population. Moreover, it collects data continuously, allowing researchers to track quickly-evolving trends that other tools might miss.

"We're not just observing people for one or two days, we observe them continuously and see how their behavior changes over time," Xiong said. "It's real time, it's dynamic, and it's continuous. With our real-time, continuous data, we can identify mobility patterns as early as the next day, and if we see a concern we may be able to alert federal and local governments so they can take proactive action to prevent a pandemic from happening."

Pilot studies will be carried out at the UMB Institute of Human Biology's (IHB) campus in Nigeria and at universities in South Africa, enabling the researchers to test their models in a region that has been hit hard by COVID-19 and other infectious diseases.

Xiong expects the MTI database to spur many further projects in the future. "It's an unprecedented opportunity for collaborative research bringing together transportation and other fields, including public health, public policy, and economics," he said.

Cui leads groundbreaking study on **project delivery methods, equity**

First-of-its-kind study provides empirical data on the track record of Public Private Partnerships (P3) in setting Disadvantaged Business Enterprise (DBE) goals.

Public Private Partnerships (P3) have been widely lauded but also criticized, with some charging that they favor large, well-established players and do little to foster a more equitable environment for female and minority-run businesses. Until now, however, empirical data to support or refute those claims has been lacking.

A recently-released study, conducted by UMD Civil and Environmental Engineering Professor Qingbin Cui and doctoral student Kunqi Zhang, and published by Transportation Research Record, aims to fill in the data gap. It is the first ever to empirically test how different delivery methods correlate with the setting and attainment of DBE goals—typically expressed in terms of the percentage of contract dollars expected and actually awarded to minority and women-owned businesses that participate in federally-funded transportation projects.

And its findings are surprising. Not only do P3 projects have a better track record in setting equity goals than many assume, but they actually outpace Design-Bid-Build (DBB), a more traditional delivery method.

"The conventional wisdom turns out to be wrong," Cui said.

Drawing from the U.S. Major Highway Projects Database, Cui and Zhang sampled 134 federally assisted contracts. Linear regression models created by the team showed that two delivery methods—Design Build/Construction Manager at Risk and P3—outpace DBB in setting equity-related goals.

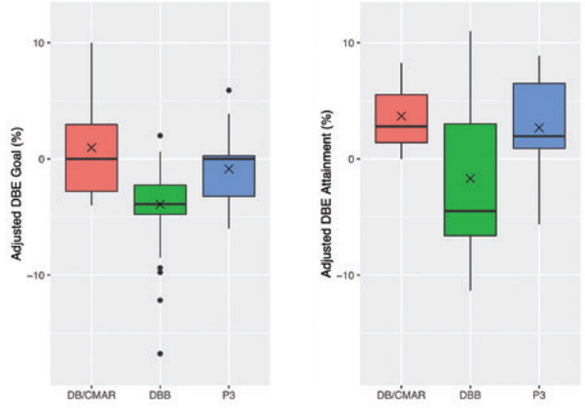
In Ohio, for instance, value-weighted DBE goals stood at 14.3% for P3, 10.7% for Design Build/Construction Manager at Risk, and 9.2% for DBB; in Texas, the numbers were 12.8%, 9.9%. And 8.0%. Similar trends were found nationwide, and DBE goals were also found to be the most robust predictor of actual DBE attainment.

Contract size is an important factor, Cui and Zhang found: the larger the contract, the more opportunities for subcontractors in turn fostering a greater capacity to meet DBE goals. And both P3 and DB/CMAR dwarf DBB when it comes to contract size, with average amounts of $954.2 million, $466.6 million, and $89.1 million, respectively.

"Larger-scale contracts offer more opportunities for businesses that might otherwise not be able to get a foot in the door," Zhang said.

P3 projects may also have an incentive to promote diversity and equity because of the amount of public scrutiny these large, high-profile projects often generate. "There's a public relations component," Cui said. "Companies involved in these projects are in the media spotlight and they want to be seen as doing the right thing."

The primary source for the study—the U.S. Major Highway Projects Database—was also developed at UMD, under Cui's direction. Unveiled in 2019, the tool covers nearly two decades of highway projects and allows researchers a ready means to make cross-project comparisons. Cui and Zhang conducted their research with support from the Maryland Transportation Institute, a research hub that brings together transportation experts from across the University of Maryland to devise interdisciplinary solutions to transportation challenges.



DBE GOAL AND DBE ATTAINMENT WERE ADJUSTED BY THE AGENCY'S OVERALL GOAL TO ACCOUNT FOR THE DIFFERENT DBE AVAILABILITY IN EACH STATE.

Transportation and equity: a need for new solutions

Starting this past September, users of the DASH bus system in Northern Virginia have benefited from a new perk: free fares. It's part of an experiment aimed at incentivizing greater use of public transportation—and making it more accessible to lower-income riders. The cost and availability of public transportation is one of the many transportation-related hurdles that affect lower-income Americans and contribute to socioeconomic inequities, notes UMD Civil and Environmental Engineering Professor Cinzia Cirillo, an expert on transportation demand analysis, forecasting, and planning, and the lead researcher on a project designed to evaluate the results of the DASH experiment.

In the following interview, Dr. Cirillo highlights some of the ways in which transportation policies can exacerbate inequality—and what steps can be taken to counter the problem.

What are some of the most significant ways in which transportation can contribute to inequity?

Certain policies and programs are known to exacerbate inequity. With toll roads, for example, the fee may be acceptable to higher-income people, but unaffordable to those with lower incomes. As a result, entire groups of people are effectively prevented from making use of public infrastructure. Other examples include imposing taxes on gasoline, increasing the price of public transportation, or eliminating services.

The decisions we make about where to build transportation infrastructure can also have adverse impacts. A highway built through a neighborhood can become a barrier and create social exclusion, as has happened in a number of cities.

Among transportation researchers and policymakers who are interested in promoting greater equity, what solutions are attracting the greatest interest?

Much of the attention is being focused on two main areas: making services less expensive for lower income people and improving the quality and accessibility of services. In Alexandria, Virginia, for instance, DASH has modified its network to cover more locations and increase the frequency of service, and they have also instituted free fares on DASH buses, as of September. They hope in this way to attract more people to public transportation and increase ridership, and at the same time, improve accessibility for lower-income riders. My role is to monitor the changes in behavior that occur as people adapt to the new situation, and to quantify the benefits.

Do you see an expanded role for public transportation in the future?

Public transportation makes sense in a dense area, like the DMV. It doesn't make sense, given the density, that our public transportation options are so limited. The frequency and availability of services can and should be increased: for example, services that are currently limited to peak hours could run at other times as well. This is easy to do, doesn't cost a lot of money, and will attract more riders.

Another step that has proven to be successful is to create dedicated bus lanes in commuter corridors. We want to make buses an attractive alternative: they're not just a lesser option for people who can't drive their own car. If we maintain a high quality of service and lower the cost, people will see the benefits: you can get to work on time, without the stress of driving in congested traffic, and you'll save money. Providing this level of service is achievable.

Newer modalities, such as Mobility-as-a-Service (MaaS), have generated much interest, but they are not very affordable to lower-income people. Can they be made more equitable?

Although everyone's talking about MaaS, the share of people using these services is still very low. They're not at the point where they can cover a significant share of transportation needs, and it remains to be seen whether MaaS will ever become more than a niche concept. That said, some transportation agencies are considering whether they could be used to cover the so-called "last mile" between a rider's home and the nearest bus stop or train station. It might be feasible to provide people with vouchers so they can use rideshare for this purpose.

What are some of the ways in which the COVID-19 pandemic has exacerbated transportation-related inequities?

At the height of the COVID-19 pandemic, many stations were closed and services were curtailed. That created great hardships for the front-line workers who depend on these services and who did not have the luxury of working from home. They not only had to face health risks because of the need to travel to their jobs, but they also faced difficulties in getting there due to the cutbacks in service.

What are some other projects you've worked on that relate to transportation and equity?

My team has also conducted research on the need for evacuation of lower-income people during natural disasters. There is a strong correlation between being low income and not having a car. Very often, evacuation orders assume that the evacuees will leave using their own cars—but, as we saw in the case of Hurricane Katrina, this can result in leaving many people stranded without a way to get out. In our project, we were able to predict how many people in a given scenario did not have cars, thus enabling authorities to organize alternate means of transit.

Another project focuses on the role transportation plays in determining job accessibility. In the past, lower-income people who lived in Washington, D.C. had access to Metro and could get to their jobs. But these populations are now being pushed out of D.C. into the surrounding counties, such as Prince George's, where there is less public transportation. Jobs today tend to center around certain corridors, many of which are hard to reach by bus or Metro. As a result, access is lost.

Towards a **safely shared airspace**

A feasibility study commissioned by the UMD UAS Test Site examined the viability of establishing a UAS route network in the Chesapeake Bay region.

It's an idea that people have been discussing for years: create a corridor in the Chesapeake Bay area in which unmanned aircraft could conduct operations, sharing airspace with their manned counterparts.

During 2020, even as the COVID-19 pandemic kept its hangars shut, the UMD UAS Test Site took a significant first step towards turning this bold concept into reality, commissioning a feasibility study that examines whether a proposed Chesapeake Bay UAS Route Network is a viable endeavor.

The study, completed in January 2021, was carried out by the Padina Group, a consulting firm that specializes in aerospace and aviation, with the participation of key industry and government stakeholders, including the Federal Aviation Administration's (FAA) UAS Integration Office.

It represents the first major effort to map out details of the proposed network, which would be designed to enable unmanned aircraft to be flown safely within airspace that also includes conventional, piloted aircraft.

Unmanned aircraft systems (UAS) utilizing the network would be able to fly beyond visual line of sight (BVLOS) and over populated areas. Currently, most UAS operations are constrained by BVLOS requirements and restrictions on flying over people.

"There is a widespread consensus that integrating UAS into non-segregated airspace is critical to realizing the vast potential of unmanned systems," said UMD UAS Test Site Director Matt Scassero. "But it has to be done safely and systematically, with a well-conceived framework and operational best practices. The Chesapeake Bay UAS Route Network will provide an appropriate means to move forward."

To iron out the specifics, the Padina Group analyzed the geospatial operating environment, identified the advanced UAS capabilities needed for safe and efficient operation, and assessed the level of support for such an initiative as well as the potential economic benefits. Public policy challenges were also discussed. The feasibility study laid out a blueprint for phased implementation of the proposed network.

"The Chesapeake UAS Route Network initiative has strong enthusiastic support from Operational Users and Network Implementation Service Support Suppliers. This, coupled with having already defined operational missions for the UAS route network, clearly demonstrates a high credibility of achieving the Chesapeake UAS Route Network goal and objectives," the report concluded.

The UAS Test Site could conduct advanced UAS operations on the Chesapeake UAS Route Network, and in doing so, play a key role in supporting and shaping FAA regulations and policies, as well a serving as a model for future, the report suggested.

According to John Walker, senior partner with The Padina Group, the Chesapeake Bay region is poised to take on a historic role.

"Technology advancements within the aerospace industry have generated a 'Kitty Hawk' moment that is revolutionizing global air transportation," Walker said. "The innovative use of drones for commercial purposes is recognized as an early enabler of this new aircraft technology."

"The Chesapeake Bay is close to the site where the Wright Brothers successfully took flight in December 1903," he noted. "Now, in 2020, the Bay region is poised for the development of new technology and services that will benefit millions. This emerging air transportation technology will bring important public benefits and connect with other transportation systems throughout the region."

Who we are

Led by the University of Maryland, MTI brings together interdisciplinary transportation expertise from across Maryland universities to develop and deploy innovative solutions that address urban and rural transportation problems. Through partnerships with our government, non-profit, and private-sector collaborators, MTI helps pioneer cost-effective ways to improve safety, reduce congestion, promote sustainability, enhance equity, and preserve infrastructure. With our team of leading international experts in engineering, planning, data analytics, computer and information sciences, social sciences, business and logistics, public policy, public health, and the humanities, MTI is uniquely equipped to foster new approaches that fuel community and economic development in Maryland and beyond.

WHAT WE DO

- Big Data & Data Analytics
- Connected & Automated Transportation
- Economics & Policy
- Freight & Logistics
- Infrastructure
- Modeling & Simulation
- Planning & Environment
- Performance Monitoring & Management
- Safety & Security
- Traffic Operations & Control

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- Center for Advanced Study of Communities and Information
- Center for Advanced Transportation Technology
- Center for Advanced Transportation Technology Laboratory
- Center for Geospatial Information Science
- Center for Global Sustainability
- Center for Health and Risk Communication
- Experimental Economics Laboratory
- FAA Consortium in Aviation Operations Research
- Human Computer Interaction Laboratory
- I-95 Corridor Coalition
- Interindustry Forecasting Project
- Maryland Transportation Technology Transfer Center
- National Center for Smart Growth Research and Education
- Supply Chain Management Center
- Traffic Safety and Operations Laboratory
- Unmanned Aircraft Systems Test Site
- Urban Computing Laboratory
- Urban Mobility & Equity Center

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UMD launches **transportation economics and policy blog**

JOSHUA LINN, PROFESSOR, UNIVERSITY OF MARYLAND SCHOOL OF AGRICULTURE AND NATURAL RESOURCES

From equity to the environment, the transportation field intersects with many other critical concerns. A newly-launched blog provides expert analysis and commentary on transportation policy issues and their broader context.

The UMD Transportation Economics and Policy blog provides a space for informed commentary on ongoing market and policy developments in transportation, drawing on research at UMD, said lead author Joshua Linn, associate professor in the Department of Agricultural and Resource Economics and an MTI affiliate.

"Our aim is to highlight timely research we're doing and provide insights into current events, such as public debate over transportation sector policy as it relates to infrastructure, environmental policy, and other issues," Linn said.

Though an initial focus on U.S. policy regarding electric vehicles is planned, Linn will be expanding the blog's scope in the coming months to cover climate-related policy (both at the state and federal levels), and problems with access and equity. "The nice thing about writing for the blog is that I can transition quickly to cover current events, which is much harder to do with long-term research," Linn said.

In addition to Linn, the blog will regularly feature guest authors, including UMD students and faculty members, giving them an opportunity to highlight their research. Experts from outside UMD will also be invited to contribute occasional guest posts, thus enabling greater diversity of topics.

Posts are pitched to a broad audience that includes researchers in academia and at non-profits, representatives of the media, policymakers, and members of the general public with an interest in transportation policy, Linn said.

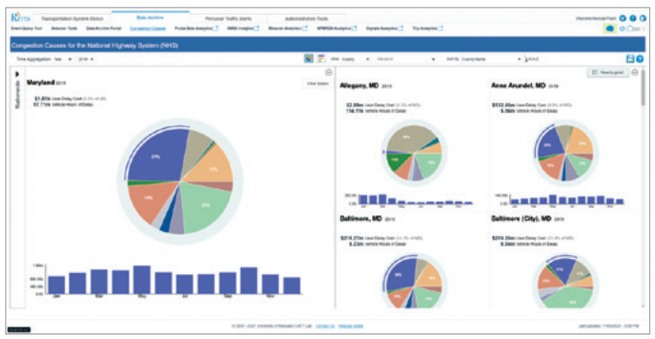
In the future, the blog will also highlight research projects supported by a grant to UMD from the Sloan Foundation, which supports one-year transportation economics and engineering Ph.D. fellowships.

> Want to learn more? Contact Dr. Linn at **linn@umd.edu**

Center for **Advanced Transportation Technology**

CATT LAB INNOVATIONS HELP DETECT QUEUES ON THE CHESAPEAKE BAY BRIDGE

This past January, the Center for Advanced Transportation Technology Laboratory (CATT Lab) kicked off a 13-month project to develop a Queue Monitoring and Prediction System for US 50 and the Bay Bridge in Maryland. The Lab will receive new sensor data installed at key locations and aggregate it with existing roadway, event, and probe data to measure, predict, and report traffic performance through the RITIS Platform (accessible from both a desktop or mobile device).

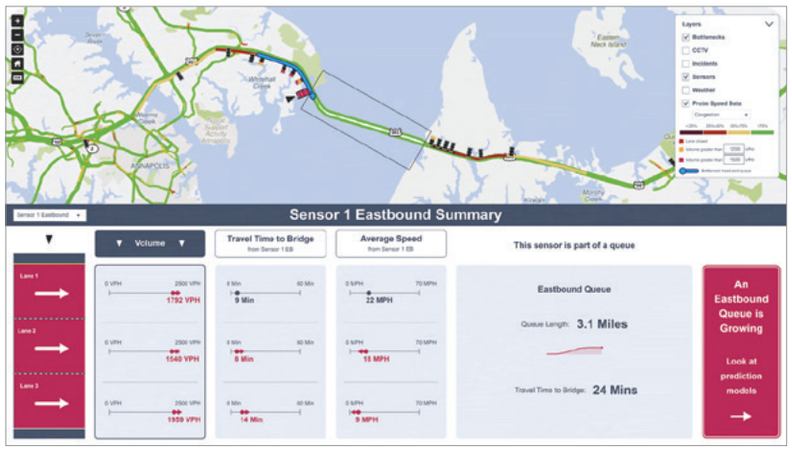


The system will be used to assist traffic operations staff in optimizing capacity allocation on the bridge by providing advance notice of 1) when to switch the contraflow lane on the westbound bridge between eastbound and westbound based on traffic volumes and congestion; 2) when Maryland Transportation Authority (MDTA) should require contractors to quickly "lift" lane closures to provide more lanes for traffic; and 3) when MDTA should allow contractors to work beyond the scheduled end-of-the-lane closure to keep the lanes closed longer because there is not much impact on traffic.

CAUSES OF CONGESTION PIE CHART RECEIVES FUNDING TO SCALE DATA AND ANALYSIS TO ALL U.S. STATES AND COUNTIES

The CATT Lab spent the last year developing an innovative methodology to use real-world data to compute the causes of congestion for each county in the state of Maryland. Researchers fused weather, speeds, signals, incidents, holidays, and work zone data to pinpoint the locations and severity of congestion and to assign a probable reason or "cause" of said congestion.

The results of this project, which also evaluated every county in the entire United States for calendar year 2019, has been deployed to a web-based dashboard in RITIS that allows agencies to look at the causes of congestion for their state month-by-month, quarterly, seasonally, or annually.



Several states are already using the results of this data to justify continued investments in operations strategies. The Florida Department of Transportation has also used this information with a broad proclamation for Crash Responder Week to impress upon the public and legislature the criticality of transportation operations.

According to the analysis, Maryland drivers on NHS routes experienced over 57 million vehicle hours of delay in 2019, which equated to over $1.52 billion in user delay costs. Furthermore, the analysis shows that only about 27% of the congestion was recurrent. Signals accounted for at least 20% of the delay, and incidents, weather, and other events accounted for about 30% of the user delay.

In the coming months, the CATT Lab is enhancing these tools to allow MDOT to analyze individual corridors, date ranges, and times of day to help MDOT target congestion countermeasures and further refine mitigation investment strategies at specific locations.

> For more information, visit **catt.umd.edu**

Center for **Global Sustainability**

Can the U.S. slash carbon emissions in half by 2030? That's the ambitious goal set forth by the Biden administration. But what steps will need to be taken to achieve it? Researchers at the Center for Global Sustainability (CGS) have been addressing these questions.

Transportation constitutes an important part of any strategy to meet the U.S. Nationally Determined Contributions (NDC) under the Paris Agreement. The most recent report from the America Is All In coalition, which CGS co-led, identifies transportation as a key sector for emissions reductions. Emissions from transportation will need to decline by 39% from 2005 levels by 2030—accounting for 20% of economy-wide emissions reductions. The swift transition in the transportation sector needed to meet these reductions requires widespread phase-outs of internal combustion engines, deployment of zero-emissions vehicles, and broad investment in electric vehicle (EV) infrastructure.

"OUR RESEARCH DEMONSTRATES THE IMPORTANCE OF A MULTI-STAKEHOLDER APPROACH"

"Action must be taken at all levels of society—nationally, state, city, business, university, and more—to achieve 50% reductions," says Leon Clarke, CGS Acting Director. "Businesses can finance charging infrastructure, cities and civil society can prioritize publicly available infrastructure, states can mandate zero-emission vehicles, and the federal government can set vehicle standards," he said.

Exploring the significant roles across society is part of CGS's core analytical work. Assistant Professor Kavita Surana has been studying how the emerging technologies necessary for the clean energy transition can be funded, incentivized, and adopted through multi-stakeholder collaboration. Recent research looks at how collaboration between climate-tech start-ups and federal agencies can enhance technology deployment.

"Our research demonstrates the importance of a multi-stakeholder approach to drive innovation and smart climate solutions," says Shannon Kennedy, senior manager of strategic engagement. "We know that advanced batteries are essential to power the zero-emission vehicle transition. Although the technology is largely there, without collaboration across our federal, state, and city governments, labs and universities, investors and startups, community groups, and more, we will not achieve the affordable and attractive electric vehicles needed to transition the economy."

CGS is a think tank housed in the University of Maryland's School of Public Policy. The CGS Director, Professor Nathan E. Hultman, is currently on leave as a senior advisor to John Kerry, Special Presidential Envoy for Climate Change. Research Professor Leon Clarke is currently serving as the acting director.

> You can find all the Center's research, news, and updates at **cgs.umd.edu**

Center for **Health and Risk Communication**

The old proverb is wrong: what you don't know can in fact hurt you. Whether the subject is COVID-19, the dangers of opioid use, or safe sex, public health depends on effective messaging and communication, and misinformation can have deadly results.

"COVID-19 showed us many examples of the importance of communication," says Xiaoli Nan, director of the University of Maryland's Center for Health and Risk Communication (CHRC). "Effective public health messaging mobilizes pandemic risk-reduction behaviors and fights against the potential harm of misinformation."

In their work, Nan and other CHRC researchers investigate the vital link between information and public health outcomes in contexts ranging from the personal (e.g. cancer prevention, immunization, sexual health) to the global (e.g. climate change, pandemic response).

CHRC researchers examine communication strategies for promoting vaccination among general and underserved populations. They study how sexual health messaging influences attitudes and behavioral intentions among young adults and how controversial science topics are communicated through online media. Other CHRC projects include studying how weather forecasters warn the public about tornado risks, and developing an app to promote agricultural safety and prevent tractor overturning.

Transportation, too, has a public health aspect: studies have linked air pollution generated by vehicle emissions to increased risk of cardiovascular problems, strokes, and other health conditions. CHRC has been working with MTI to study public acceptance of a new app, incenTrip, that aims to "nudge" commuters into making greener and healthier travel choices, such as using public transit. Leveraging CHRC's communication expertise, the project sought to understand public views regarding the app and identify effective communication strategies to encourage widespread adoption of the new technology.

CHRC is also spearheading a Cancer Communication Initiative, which aims to promote cross-disciplinary collaboration in cancer communication research, cultivate the next generation of cancer communication scientists, and inform and empower disadvantaged communities in their fight against cancer. In addition to CHRC, partners in this initiative include the School of Public Health at UMD, the School of Medicine at the University of Baltimore, the Marlene and Stewart Greenebaum Comprehensive Cancer Center, and other organizations and individuals committed to reducing cancer burden in the U.S. and worldwide.

> For more information, visit **healthriskcenter.umd.edu**

IN ONE UMEC PROJECT, RESEARCHERS BROUGHT A BALTIMORE BUS PAD INTO THE LAB TO STUDY DEFECTS IN ITS CONSTRUCTION.

Urban Mobility and Equity Center

As transportation continues to change and evolve, opportunities exist to improve accessibility. And with environmental concerns on the front burner, policymakers are looking for sustainable solutions. The Urban Mobility & Equity Center (UMEC), based at Morgan State University (MSU), brings together researchers with an interest in improving urban mobility of people and goods while ensuring both equity and environmental sustainability.

"Our goal is to conduct research that will make a tangible impact in the real world," said UMEC Director Mansoureh Jeihani of the Center, which includes the University of Maryland and the Virginia Polytechnic Institute as participating members.

A U.S. Department of Transportation Tier 1 research center under the Fixing America's Surface Transportation (FAST) Act, UMEC has supported over 45 new, ongoing, and completed projects with focus areas that include increasing access to opportunities, smart cities, novel modes of transport, systems integration, analytical tools to optimize movement, and regional planning.

In one, UMD Civil and Environmental Engineering Professor CInzia Cirillo and Javier Bas Vicente from Universidad de Alcalá created a tool that enables policymakers to locate vulnerable populations—particularly those without cars—who may be at risk of being stranded during an emergency evacuation. In another, National Institute of General Medical Sciences Program Director Kadir Aslan and MSU Professor Mehdi Shokouhian investigated the methods being used to construct concrete bus pads in Baltimore and then created a set of "best practices" that can be used in the future. "They actually dug up a bus pad and brought it into our lab," Jeihani said.

In a current project, Jeihani and MSU researcher Eazaz Sadeghvaziri are studying the correlations between biking and walking activities and income, with particular attention to low-income African-Americans. The study looks at variables such as number of walk trips, number of walk trips for exercise, number of bike trips, number of bike trips for exercise, and bike share program usage, with an eye to how these are affected by income and race. Findings can potentially provide policymakers with a better understanding of active transportation mode usage among minorities, enabling them to better prioritize investments in walk and bike infrastructure. Other current UMEC research covers Mobility-as-a-Service (MaaS), intelligently connected vehicles, and the impact of COVID-19 on mobility, accessibility, and equity.

While research is a crucial component of UMEC's activities, the Center is also involved in education, outreach, and workforce development. Its summer transportation program draws high school students, many from underrepresented communities, to learn about transportation issues and STEM. And its highly successful internship program, conducted in partnership with the Maryland Department of Transportation (MDOT), has resulted in numerous hires. "Our graduate students do a full-year internship through the program," Jeihani said. "Very often, agencies want to hire them even before they've finished their degree."

> For more information about UMEC activities and programs, visit **www.morgan.edu/umec**

Shelby Bensi

ASSISTANT PROFESSOR,
CIVIL AND ENVIRONMENTAL ENGINEERING

DIRECTOR, RISK-INFORMED SOLUTIONS IN ENGINEERING (RISE) LAB

Transportation infrastructure exists to meet human needs. But sometimes nature can introduce complications.

When building or renovating infrastructure, engineers must consider the risks posed by natural hazards, and how to address them. That's where experts in probabilistic risk assessment (PRA), such as UMD Civil and Environmental Engineering Assistant Professor Michelle (Shelby) Bensi, can provide critical input.

"When we're designing a bridge to resist earthquakes, or deciding how to route a road, or siting transportation facilities such as airports, we need to make design decisions about what hazards we're going to design for, as well as what level of hazard," Bensi said. "Is there a risk of frequent flooding? Does a bridge need to be raised higher so it won't be washed over?"

An engineer with the Nuclear Regulatory Commission (NRC) before transitioning to academia, Bensi uses mathematical tools and data analysis to help answer the question, "how frequently could we expect a certain hazard to happen, and how is the likelihood changing—whether because of climate change, or because of changes in our scientific understanding?" Her current projects include a U.S. Department of Transportation study, undertaken in collaboration with fellow UMD Civil and Environmental Professor Kay Brubaker, on the impact increased precipitation levels could be having on roadways and other infrastructure.

More broadly, Bensi is working to develop a framework that will enable specialists in different hazard areas to communicate and collaborate effectively. As she explains, "historically, risk assessment has been characterized by very siloed approaches. If you're trained in earthquakes, you do it this way; if you're trained in storm surges, you do it another way."

"But all of these things matter when we try and design critical infrastructure, so why are we addressing them so differently?" The compartmentalization is particularly onerous, she says, because hazards often occur in combination. A hurricane, for instance, can generate enough wind and rain to cause rivers overspill, in turn leading to floods.

With support from an NSF CAREER award, Bensi is developing a more integrated approach, based in part on the use of Bayesian networks. With a common framework and lexicon available, risk assessment experts will be able to provide more comprehensive guidance to those who plan and build infrastructure, including transportation infrastructure.

"Especially with the increase in severe weather events linked to climate change, we need to be able to address hazards in combination," she said. "That's what my work is aiming to do."

Ming **Hu**

AIA, NCARB, LEED AP

ASSOCIATE PROFESSOR, UNIVERSITY OF MARYLAND SCHOOL OF ARCHITECTURE, PLANNING, AND PRESERVATION

When designing eco-friendlier buildings, architects and engineers consider a number of factors. They measure the size of the building and calculate how much energy is required for heating and air conditioning. The power grid that it utilizes—and how much of that grid involves renewable sources—also contribute to the building's carbon footprint.

In addition, transportation to and from the building must be factored in. Driving to get to the location results in emissions; if the building is difficult to access by public transportation, or by walking or biking, the carbon footprint will be larger, often significantly so.

Determining a building's cost to the environment is the job of experts like Ming Hu, University of Maryland (UMD) associate professor of architecture. and author of the book *Net Zero Building: Predicted and Unintended Consequences*. A professional architect before she transitioned to academia, Hu conducts environmental impact assessments designed to help policymakers, planners, and developers meet green building standards, such as those set out by the Leadership in Energy and Environmental Design (LEED) rating system.

Location, Hu says, can be as important as equipping a building with energy-saving bells and whistles. "If you decide to build a commercial office space in the middle of nowhere, you're going to have a much higher carbon footprint, compared to a similar building located in a dense urban area that is located near a Metro station," she said. "The building's occupants have to drive farther to get there—and driving may be the only travel option available."

"Choosing such a location offers the benefit of cheap land and ample parking, but at a steep environmental cost," she said.

Though environmental impact assessments are not new, they are now more robust. When LEED was first launched, decades ago, Hu explains, analysts relied mainly on qualitative data gleaned from surveys. Now the field benefits from more advanced tools and algorithms, allowing for the footprint to be measured far more precisely.

Ideally, she said, the work of environmental impact assessment experts should go hand in hand with policymaking: being able to pinpoint environmental costs is of limited value if development trends continue to favor building in remote locations, accessible only by car.

"It's important for policymakers and real estate developers to know not only that a proposed new building will consume a certain amount of energy, but also that it may have a large consequence in terms of induced energy and carbon emissions," she said.

"We hope they will take a more holistic view."

Sacoby **Wilson**

ASSOCIATE PROFESSOR, MARYLAND INSTITUTE FOR APPLIED ENVIRONMENTAL HEALTH AND DEPARTMENT OF EPIDEMIOLOGY AND BIOSTATISTICS, UNIVERSITY OF MARYLAND (UMD) SCHOOL OF PUBLIC HEALTH

DIRECTOR, CENTER FOR COMMUNITY ENGAGEMENT, ENVIRONMENTAL JUSTICE AND HEALTH (CEEJH)

Decisions about transportation infrastructure take place in a context, and often that context has involved inequity and racism. Through his research and advocacy, UMD Associate Professor Sacoby Wilson has helped bring to light the human cost of policies that adversely affect Black and other historically disadvantaged communities.

Wilson directs the Center for Community Engagement, Environmental Justice and Health (CEEJH), which partners with local, state, and federal government entities, as well as with community-based organizations, to reduce local contamination, improve environmental quality, and enhance community health and sustainability—with a particular focus on underserved communities.

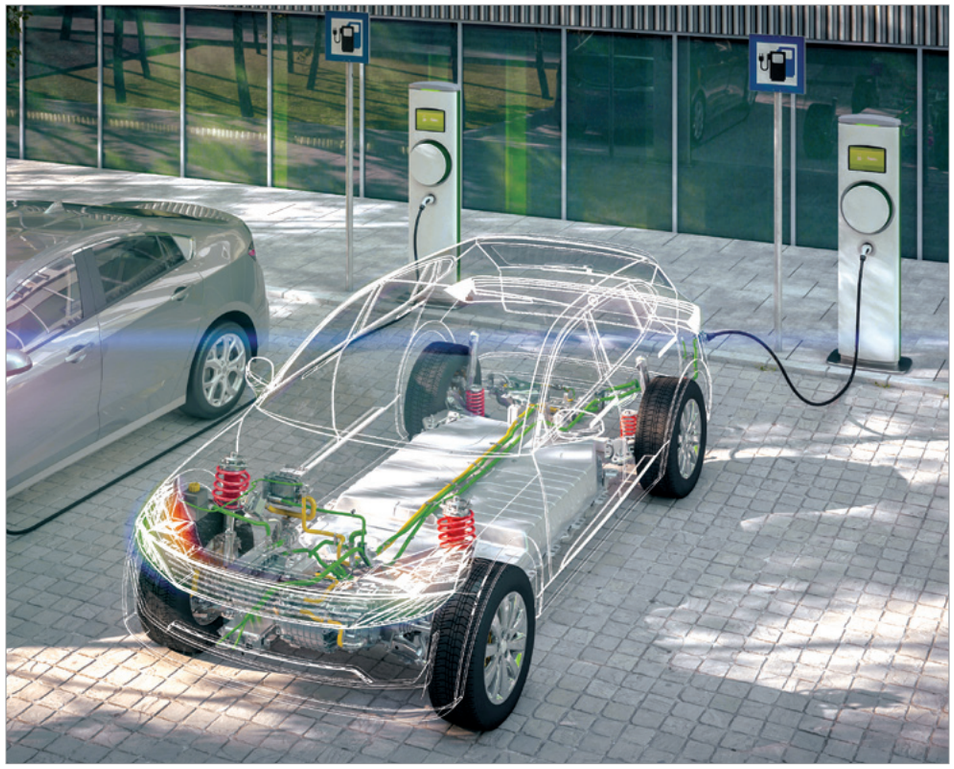
When it comes to environmental justice, transportation is a significant piece of the puzzle. As Wilson explains, the U.S. has a long track record of locating highways and byways in poorer, predominantly Black neighborhoods, which lack the political clout to influence those decisions. As a result, families living in those neighborhoods are exposed to higher levels of toxicants from truck emissions, with widespread health problems arising as a result. "People living in those corridors will have higher rates of asthma and other medical conditions," he said.

Such infrastructure choices also result in the destruction of local landmarks and in the physical division of communities, thus harming the cultural fabric. "Historic churches and cemeteries get paved over," he said. "People are displaced and their neighborhoods become fragmented. If Title VI of the Civil Rights Act had been applied rigorously, we wouldn't be seeing so many of these highways and byways being built through Black and Brown neighborhoods. But it continues to happen."

To help assess the health impact, Wilson and CEEJH have helped set up hyperlocal air quality monitoring networks, which use a combination of sensors and data analytics tools to pinpoint data analytics tools to pinpoint air quality problems more precisely than traditional methods can. Such projects are under way in several locations, including Cheverly, Maryland; Charleston, South Carolina; Savannah, Georgia; and Newark, New Jersey.

The Center also runs the Maryland Environmental Justice Screening Tool, which tracks a broad set of variables that include several associated with transportation, such as proximity to traffic. Wilson himself supplements his research work with activism; he is co-founder of the Mid-Atlantic Environmental and Economic Justice Coalition, founder of 17 for Peace and Justice, a member of the National Black Environmental Justice Network's steering committee, and advisor to student groups on the UMD campus.

BALTIMORE "HIGHWAY TO NOWHERE"



Reining in **emissions**

BY JOSHUA LINN (UNIVERSITY OF MARYLAND), BENJAMIN LEARD (UNIVERSITY OF TENNESSEE), AND VIRGINIA MCCONNELL (RESOURCES FOR THE FUTURE)

On August 5, 2021, the Biden administration announced a target that 50% of new vehicles sold in the United States by 2030 will be all-electric, plug-in hybrid electric, or fuel cell. Within a week of that announcement, the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Transportation (DOT) announced new fuel economy standards and greenhouse gas standards that cover new vehicles through model year 2026. Automakers can meet the standards by increasing the fuel economy of the gasoline-powered vehicles they sell. The standards also incentivize automakers to sell more electric vehicles (EVs), which include all-electrics like the Tesla Model 3 and plug-in hybrids like the Chevy Volt.

FUEL ECONOMY STANDARDS WILL HELP SPEED THE DEPLOYMENT OF ELECTRIC VEHICLES, BUT MAY NOT BE ENOUGH TO ACHIEVE THE 2030 TARGET

But how much will the standards actually help in achieving the Biden administration's 50% goal? According to the analysis that the EPA and DOT conducted of their own proposals, the answer is: maybe not that much.

Figure 1 (see page 21) uses the data the agencies provided to compare how increased fuel economy and increasing shares of EVs contribute to total emissions reductions. These data are generated from a detailed simulation model that predicts manufacturer compliance based on the costs of available compliance options, which include increasing fuel economy or electrifying existing vehicles. For vehicles sold in the indicated model year, the blue bars in Figure 1 show the total emissions reductions over the lifetime of those vehicles compared to lifetime emissions if standards had stayed at 2022 levels. The orange bars show projected emissions reductions based on how much the agencies expect sales of EVs to increase; specifically, the agencies currently project EV market share to increase from 2.4% in 2022 to 8% in 2026. For the sake of this article, we make the simplifying assumption that all EVs reduce emissions to zero from the emissions of an average gasoline vehicle; this overstates the emissions reductions from EVs, because the assumption of zero emissions does not include emissions from the electricity generated to charge the EVs.

Even with this overestimate of emissions reductions from EVs, the agencies predict that significantly more emissions reductions over the next five years will be attributable to gasoline vehicles than to EVs. Gasoline vehicles still account for about 86% of the total emissions reductions in model year 2026. The EV market shares may turn out to be higher than the agencies anticipate—considerable uncertainty about the future of EV sales exists, after all—although our own analysis of similar standards comes to similar conclusions. However, if EV sales continue to comprise an increasing proportion of total vehicle sales, then EVs will begin to play a larger role in emissions reductions.

Three key reasons can explain why EPA and DOT predict that the new standards may not affect EV sales all that much over the next few years. First, when automakers increase the fuel economy of their gasoline vehicles, those vehicles become more expensive to produce. The agencies predict that tighter standards will increase average vehicle costs by $1,000 in 2026. But if battery costs fall only modestly between now and 2026, then EVs may continue to be more expensive than comparable gasoline vehicles, especially for popular larger vehicles such as trucks. Automakers may not be able to shift their production to EVs due to this continued disparity in costs.

Second, California and 12 other states implemented a Zero Emission Vehicle (ZEV) program that sets requirements for plug-in and fuel-cell market shares in those states. By 2025, the market share for EVs in ZEV states is predicted to rise to at least 6%. The Biden administration standards likely will have a small incremental effect on EV sales in those states. Because those states account for one-third of all new vehicle sales, the ZEV standards dampen the effects of federal fuel economy standards on EV sales.

Third, in the proposed standards, EVs earn additional greenhouse gas credits for manufacturers beyond the extent to which the EVs actually reduce emissions relative to gasoline vehicles. This over-crediting creates additional incentives for automakers to sell EVs, but also effectively weakens the standards, because the overall average greenhouse gas emissions rate will be higher than if the EVs were credited normally. This outcome further dampens the effects of the fuel economy standards on EV sales. The agencies recognize that these incentives may reduce the effective stringency of the standards in the short run, but EPA and DOT believe that the incentives will encourage broader application of new technologies and lead to lower costs in the long run.

We encourage EPA and DOT to demonstrate the cost-effectiveness of over-crediting EVs. Using straightforward methods, the agencies could compare scenarios with and without over-crediting, and they could show the welfare costs of any increase in EV sales caused by the over-crediting. This approach would be more transparent than what the agencies currently do, which is simply to assert that over-crediting increases EV sales, but without providing estimates of the costs.

If the standards won't have much effect on EVs, then what might the standards accomplish? As we have described above, the standards will play a key role in reducing emissions from gasoline and diesel vehicles. The tighter standards also will make gasoline vehicles more expensive. As battery costs continue to fall, EV production costs may fall below gasoline vehicle production costs; in other words, the higher costs of gasoline vehicles may not affect market shares in the short term, but they could have bigger effects in the long term. Finally, Congress is considering major investments in public charging stations and increased subsidies to consumers for buying or leasing EVs. These subsidies could interact favorably with the new standards to increase the share of EVs on the road, but the ultimate outcomes depend on how Congress decides to act.

THIS ARTICLE FIRST APPEARED ON THE UNIVERSITY OF MARYLAND TRANSPORTATION ECONOMICS AND POLICY BLOG (HTTP://BLOG.UMD.EDU/TRANSPORTATION).

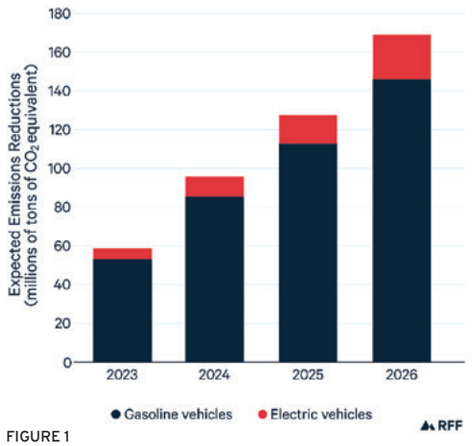


FIGURE 1

Student stories

LAVAN T. BURRA

As the European Commission (EC) works to create sustainable energy solutions, UMD civil and environmental engineering Ph.D. student Lavan T. Burra is contributing his expertise. Burra, who is completing his doctorate under the supervision of Professor Cinzia Cirillo, has been tapped by the RWI-Leibniz Institute for Economic Research as part of the EC's Smart Value Generation by Building Efficiency and Energy Justice for Sustainable Living (Smart-BEEjS) initiative. "My research at RWI is centered in the fields of energy and transportation economics with an initial objective of investigating the impact of public charging infrastructure on the uptake of electric cars in Germany," Burra said.

It's been a busy year for Burra, who earlier won the UMD civil and environmental engineering department's Best Master's Thesis award for a study examining how gasoline price changes can affect patterns of vehicle usage by multicar households. Burra has collaborated with Dr. Cirillo and Dr. Anna Alberini, a UMD professor specializing in agricultural and resource economics, on a collaborative research program with the Department of Agricultural and Resource Economics, designed to evaluate different measures of annual miles based on data obtained from the U.S. National Household Travel Survey. He has also co-authored a paper with Professor Cirillo on the rebound effect for passenger vehicles in response to the Environmental Protection Agency's Safer Affordable Fuel-Efficient (SAFE) rule.

Burra's work reflects a breadth of knowledge that encompasses not only transportation engineering but also economics and statistics. He leverages his background in these areas in order to illuminate the larger contexts affecting specific transportation issues. "My research work at UMD has helped me gain knowledge in the area of vehicle ownership and usage, energy policies related to it, and the adoption of new technology vehicles," he said. "I'm also interested in the future of electric vehicle adoption, consumer behavior, and environmental performance of these advanced vehicle technologies."

ZEINAB YAHYAZADEH JASOUR

In Dorchester County, Maryland, the effects of climate change are apparent—and having an impact on communities. The historic county, birthplace of Harriet Tubman and epicenter of the state's seafood industry, is slipping under water as sea levels rise because of climate change. Notes UMD civil and environmental engineering doctoral student Zeinab Jasour: "Roads are flooding with only a small amount of rain, and people are losing their access. They can't get out to buy groceries. They can't go to their jobs. Their kids are missing school."

Working with her mentor, UMD Assistant Professor Allison Reilly, Jasour has been studying how climate is affecting transportation and the movement of goods and people around the Eastern Shore. "It's important to look at the entire network," she said. "Say we decide to protect a particular road and not another. What will this mean for people in the area? How much longer will it take them to get to where they need to go?"

Such questions are particularly urgent because many communities in Dorchester County—including those situated on islands—have only one way in and out. The loss of a single road can isolate large sections of the county. While some key roads can be raised or buttressed with levees or seawalls, others cannot be saved even with the most ingenious tools engineers can offer. In those cases, Jasour said, residents will need to think about relocation.

The current project is one of three that Jasour has undertaken together with Reilly, all dealing with the effects of climate change. In the others, she has focused on spatial risk assessment of parks by identifying their vulnerabilities and proposing approaches (via SWOT analysis) to improve their resilience capacities, and on the impact of climate change on agriculture in Maryland's Eastern Shore. All three projects can be utilized by communities as they map out the best strategies for protecting their way of life in the decades ahead.

YOUNGMIN CHOI

Companies that deliver food and other goods have to make decisions each day about how to allocate resources. They must determine the optimal routes and calculate the number of vehicles needed. Miscalculations can be consequential: perishables may go bad, or excessive fuel costs may be incurred. Calculating the resources needed, however, is a complex, computationally intensive task that can require more time and resources than a company has available.

Youngmin Choi, who recently completed his doctorate at UMD's department of civil and environmental engineering, has been using his transportation modeling expertise to develop a speedier alternative. In his Ph.D. thesis, Choi presents a model that can deliver results in just a few seconds. "Although it's not exact, the model is accurate enough that companies can use it for planning purposes," Choi said, "And it can be used to analyze any kind of transportation system—not just trucks or rail."

That includes drone deliveries of food or cargo. In rural and remote areas, including the Appalachians, interest has mounted in using unmanned systems to reach isolated populations. But drone delivery companies, like their counterparts in trucking, also need to allocate resources efficiently. Choi's model can help them do that.

Choi, who completed his doctoral work under the supervision of Professor Paul Schonfeld, is familiar with the particular challenges facing mountain communities: in 2019, he was selected as a Transportation Fellow by the Appalachian Regional Commission, which works to promote economic development in the Appalachian states. As part of his fellowship, Choi monitored and evaluated road projects, including local access roads as well as larger arteries built as part of the Appalachian Highway Development System.

He also used his transportation modeling expertise to assist Appalachian Harvest, a rural food hub that helps small- to medium-scale local farmers get their goods to market and optimize their delivery network. In line with his Ph.D. work, Choi focused on providing the company with models they could use to allocate resources as efficiently as possible. "Because Appalachian Harvest is delivering food across very large distances, profitability can be a challenge," Choi said. "I used transportation modeling to identify solutions for increasing profit and lowering cost. That, in turn, helps ensure the enterprise is viable."

Maryland Transportation Institute **Seminars**

MTI's Distinguished Seminar Series connects the UMD community with key players in the transportation arena, including researchers, policy experts, and representatives of state and local government.

COVID-19'S EFFECT ON BIKESHARE USAGE

Theresa Firestine

When the World Health Organization declared the COVID-19 outbreak to be a pandemic, unprecedented drops were seen across multiple transportation modes—and bikeshare was no exception. During an MTI Distinguished Seminar delivered on November 9, 2021, U.S. Department of Transportation Bureau of Transportation (BTS) Statistics Senior Economist Theresa Firestine summarized data on docked bikeshare trips during the aftermath of the pandemic declaration.

As Firestine noted, the proportion of trips by members fell during 2020, though the trend mainly affected weekday trips. Additionally, the a.m. and p.m. weekday peaks in docked bikeshare use by members became less pronounced in April through May 2020 but then gradually returned. The hours for weekend trips made by members and non-members remained unchanged in 2020 from 2019. In closing, Firestine summarized the number of docked bikeshare systems, dockless bikeshare systems, and e-scooter systems that closed or suspended operations due to COVID-19 by area served and the current systems serving U.S. cities.

RAIL TRANSPORT: ENGINEERING CHALLENGES AND ADVANCES

Dr. Magdy Elsibaie

MTI hosted a Distinguished Seminar by Dr. Magdy Elsibaie, associate director for rail transport technology and safety at the Center for Technology and Systems Management, on October 27. In his presentation, Elsibaie introduced key engineering aspects in rail transport and highlighted corresponding areas of current and future research and development activities. Topics covered during the seminar included the wheel/rail interface as a source of technical challenges to rail effectiveness and efficiency, track buckling, advanced train control systems, network analysis, system resiliency, and asset management.

COVID-19, TELEWORK, AND PUBLIC TRANSPORTATION

Dan Goldfarb

The COVID-19 pandemic upended commuting patterns, with stay-at-home orders prompting unprecedented levels of telework. Ridership on public transit systems plummeted. But not all travel modes were affected equally, according to a travel demand modeling exercise undertaken by the Northern Virginia Transit Commission (NVTC). During an MTI Distinguished Seminar on May 19, NVTC Transit Resource Center Program Manager Dan Goldfarb (PE, PTP) shared findings from the project.

Among other take-homes: rail modes that support longer-distance commuter trips—and charge relatively high fares—suffered the steepest drops due to telework. On the other hand, buses continued to provide an essential service to lower-income and front-line workers, many of whom have jobs with less flexibility.

MTI by **the numbers**

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data records collected, fused, and analyzed daily by the nation's largest transportation data center

20 AFFILIATED CENTERS AND LABS

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"The **Maryland Transportation Institute** brings together practical research and produces tangible results. From **improving safety on our roads, to reducing congestion and ensuring that all Marylanders have access to affordable, reliable transportation,** the Institute is leading the way in solving some of our state's most pressing transportation issues."

THE HONORABLE STENY HOYER, *MAJORITY LEADER, U.S. HOUSE OF REPRESENTATIVES*

>120
AFFILIATED FACULTY FROM 10 UMD COLLEGES AND SCHOOLS

>$25 MILLION
in active research awards during FY21

The **bottom line**

$1 Billion
annual total economic benefit to the State of Maryland