UNIVERSITY OF MARYLAND

DATA-DRIVEN RESEARCH TO ADDRESS CRITICAL TRANSPORTATION NEEDS AND ADVANCE THE PUBLIC GOOD

Maryland Transportation Institute

ANNUAL REPORT 2019-20

CONTENTS

A MESSAGE FROM THE DIRECTORS

As we near the end of an unusual and challenging year, health and safety continue to be paramount concerns. The COVID-19 pandemic has upended nearly every aspect of our lives, and the crisis is still unfolding. The effects may be felt for a long time to come.

Starting in early 2020, our team at the Maryland Transportation Institute (MTI) took stock of the ways in which we could support the state's response to the pandemic. We recognized that MTI has access to unique resources and expertise, including massive streams of location-based data from mobile apps. As a research hub based at the state of Maryland's flagship university, we have the capability to bring together data scientists, economists, epidemiologists, public health experts, and transportation engineers to offer an interdisciplinary approach to critical concerns.

With these combined resources, we were able to quickly launch a unique, interactive data analytics platform that tracks a wide spectrum of data relating to the pandemic's effects on health, mobility, and the economy. This essential resource is now being utilized by federal and state agencies, as well as county governments, to devise targeted and target effective approaches to containing and mitigating the effects of COVID-19.

The COVID-19 Impact Analysis Platform is one of several projects developed at MTI in response to the pandemic. Our researchers and faculty affiliates are also pioneering ways to better model the outbreak, as well as investigate its impact on consumer behavior, workplace organization, and other economic variables.

In addition, we have a wide range of new and ongoing projects dedicated to harnessing the potential of big data for the public good, including:

- investigating novel ways to nudge travel behavior changes and promote multimodal and off-peak travel, including a downloadable app supported by more than a dozen of state and local agencies in the D.C.-Maryland-Virginia region;
- analyzing mobility equity and accessibility challenges in Baltimore based on human mobility big data, and in collaboration with Morgan State University;
- supporting Smart Cities and connected and automated vehicle initiatives throughout Maryland with laboratory testing of advanced technologies;
- developing a first-of-its-kind major transportation project database that can be used to improve the delivery and evaluation of public-private-partnership (P3) projects across the nation; and
- exploring ways to use integrated, real-time data from transportation and health care systems to improve trauma care triage procedures and save lives in Maryland.

We continue to support researchers through grant programs to foster bold new thinking about transportation-related questions. In late 2019, we awarded our second set of seed grants, covering innovative research in areas such as e-scooter mobility, the use of machine learning in infrastructure health monitoring, and the development of short-range communications fobs for vulnerable road users. In 2020, we unveiled our Initiative Leader and Faculty Incentive Program, which provides funding and resources to select projects led by UMD faculty. The initial round of awards under this program covers topics ranging from equity issues in transportation to post-disaster health care access.

As the state's premier hub for transportation-related research, MTI is acting as a catalyst for change. Although life is not back to normal yet for our nation, we remain confident that we can meet the historic challenges before us with the aid of advanced technology and expertise. At MTI, we will continue to do our part.

Best regards,

Lei Zhang, PhD
HERBERT RABIN DISTINGUISHED PROFESSOR OF CIVIL AND ENVIRONMENTAL ENGINEERING
CO-DIRECTOR,
MARYLAND TRANSPORTATION INSTITUTE

Deb Niemeier
CLARK DISTINGUISHED CHAIR OF CIVIL AND ENVIRONMENTAL ENGINEERING
CO-DIRECTOR,
MARYLAND TRANSPORTATION INSTITUTE

DATA TO GUIDE DECISIONS

CRITICAL TOOLS FOR THE COVID-19 ERA

Navigating the right path forward in the face of COVID-19 requires an accurate understanding of the pandemic's impact. Metrics from the Maryland Transportation Institute (MTI), a pioneer in working with mobile device data, are yielding a clearer picture.

MTI and Center for Advanced Transportation Technology Laboratory (CATT Lab) researchers created an interactive data analytics platform that provides state and county level mobility and social distancing data with daily updates, supports hotspot monitoring and containment efforts, and helps policymakers determine the most effective ways to boost the post-COVID economy.

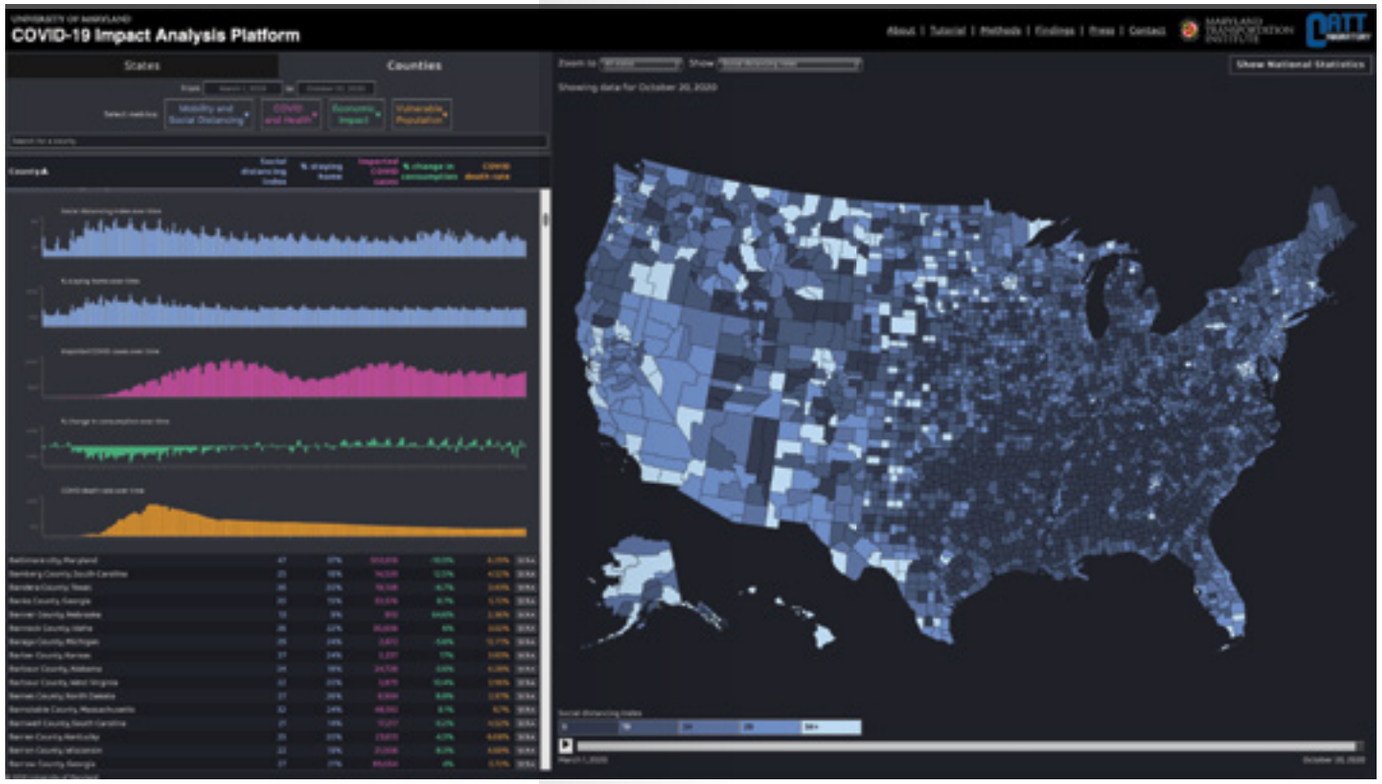
Since its launch in April 2020, the MTI platform has provided decision support to a growing number of federal, state, and county agencies.

- The U.S. Department of Transportation (USDOT) and Bureau of Transportation Statistics (BTS) uses MTI metrics to track the daily number of trips by distance across the United States.
- The Center for Disease Control and Prevention (CDC) integrates MTI mobility and social distancing data into epidemic models for prediction of future cases and numbers of deaths.
- The U.S. Department of Veterans Affairs uses the platform's Society and Economy Reopening Assessment (SERA) to help determine when to reopen certain facilities in specific states and counties.
- The U.S. Department of Treasury and Federal Reserve System use mobility and economic metrics available on the platform for economic and financial impact analysis.
- MTI has partnered with Prince George's County, Baltimore County, Baltimore City, Howard County, and other local governments in Maryland to provide data that can offer early warning of hotspots and assist in a targeted response.

By gathering and analyzing location data from opt-in apps on hundreds of thousands of mobile devices, MTI can track mobility trends, which in turn correlate with outbreak patterns.

"Our goal is to inform and support decision-makers with the best available data and interactive analysis tools," said Lei Zhang, MTI co-director and Herbert Rabin Distinguished Professor of civil and environmental engineering at the University of Maryland.

With the help of computer algorithms, the team can calculate the likely number of cases being imported across state lines. Moreover, MTI data can be utilized to conduct aggregate, community-level contact tracing and recommend localized quarantine areas shortly after a new outbreak. In one example, the team was able to generate heatmaps showing the movement of people who visited the Pleasant Valley Nursing Home, which was a site of site of a particularly severe coronavirus outbreak in March and April 2020.



THE INTERACTIVE COVID-19 IMPACT ANALYSIS PLATFORM WEBSITE AT DATA.COVID.UMD.EDU

The MTI platform, built in collaboration with UMD epidemiologists, economists, and transportation experts, has been featured in major media outlets, including *The Washington Post*, *The New York Times*, *The Boston Globe*, *Forbes*, CNN, NBC's *Today Show* and ABC's *Good Morning America*.

Visit the COVID-19 Impact Analysis Platform website at data.covid.umd.edu. For more information about the COVID-19 Impact Analysis Platform and Society and Economy Reopening Assessment, or to contact the research team, email us at data-covid@umd.edu.

"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

DATA TO SAVE LIVES

IMPROVING TRIAGE WITH REAL-TIME CRASH INFORMATION

When a road accident occurs, many variables affect the outcome, including weather, speed, crash angle, and vehicle type. Being able to access information about these variables in real time could help emergency personnel provide needed care—and save lives.

A project being led by Chenfeng Xiong, assistant director of transportation modeling research at MTI, aims to make this possible.

Xiong, who holds joint appointments at UMD and the University of Maryland School of Medicine's Center for Shock, Trauma, and Anesthesiology Research, is building an integrated platform that can pull together real-time crash data, along with data about weather, road conditions, and the vehicles involved, enabling emergency personnel to make quicker, more accurate determinations about the crash severity, the equipment and type of care needed, and the likelihood of critical injuries.

Xiong's platform combines data from mobile apps, vehicle systems, and highway sensors with information from hospitals—including data on injuries, treatment, and patient outcomes—as well as from weather services and the Center for Advanced Transportation Technology Lab's (CATT Lab) Regional Integrated Transportation Information System (RITIS). The data is then run through computer algorithms to generate metrics that can be used by medical personnel to assess cases.

"Let's say it's a rainy day and there's been a crash on I-95. Even before the police reach the crash scene, our model can calculate the likely severity and alert hospitals to the need for ICU beds and equipment," Xiong said. "First responders, meanwhile, can determine which nearby hospitals are best equipped to care for the patient, thus avoiding the risk of delays because of rerouting."

PHOTO COURTESY OF THE UNIVERSITY OF MARYLAND MEDICAL SYSTEM.

Xiong and his collaborators, including Rosemary Kozar of the Shock Trauma Anesthesiology Research (STAR) Center, have tested the approach and demonstrated that it can improve triage accuracy by more than 10%. For those involved in severe crashes, that could mean a higher chance of survivability. Many lives could be saved in Maryland alone, where around 100 fatal crashes occur each year, Xiong said.

Advances of this kind are particularly important because traffic accidents continue to be one of the leading causes of death nationwide, even as vehicles become safer and smarter.

"With some kinds of traffic fatalities, such as those involving pedestrians and bicyclists, we're actually seeing an increase," Xiong said. "We need to do all we can to reverse this trend, including by streamlining emergency processes and leveraging the benefits of big data."

ADVANCED TOOLS & TECHNOLOGIES

MEASURING VEHICLE MILES TRAVELED

The amount of time drivers spend on the road has multiple impacts; congestion levels, the probability of an accident, wear and tear on the roadway, and volume of emissions can all be affected. Yet, until now, researchers have lacked a sound methodology for calculating vehicle miles traveled (VMT)—the distance covered by a given road vehicle within a particular time frame. As a result, discussions have often relied on incomplete data and untested assumptions.

Anna Alberini, a professor in UMD's College of Agriculture and Natural Resources, has teamed up with civil and environmental engineering Professor Cinzia Cirillo to conduct a systematic analysis of real-life data, with the aim of building a toolkit that can provide policymakers with the insights they need to make informed decisions on issues ranging from transportation investment to mitigating environmental impacts.

DATA FOR HIGHWAY PROJECTS

A ONE-STOP SHOP FOR POLICYMAKERS

Agencies involved in making decisions about highway projects will soon have a valuable new tool at their disposal, allowing them to see the outcomes of past projects, make at-a-glance comparisons, and base their decisions on a wealth of relevant data.

In January, a team of researchers, programmers, and engineers at MTI completed work on a massive new database covering major highway projects undertaken across the United States since 2003. The platform incorporates implementation and outcome data from existing repositories, such as the Federal Highway Administration's Highway Performance Monitoring System and National Bridge Inventory, the Electronic Municipal Market Access (EMMA) website, project websites and archives, and documents provided by state agencies.

The result is a "one-stop shop" for analysts, policymakers, agency officials, and lawmakers, says the project's PI, Qingbin Cui, associate professor of civil and environmental engineering at UMD and a faculty affiliate of MTI. "Not only can they see how well various projects have fared in terms of cost and schedule, but they can examine the RFPs, contracts, and project reports. This can provide many 'lessons learned'," he said. "The database yields a level of transparency and accountability that was elusive before."

To make this ambitious undertaking a reality, Cui and his Co-PIs—civil and environmental engineering Professor Paul Schonfeld and Lei Zhang, Herbert Rabin Distinguished Professor and director of MTI—assembled a large team that includes transportation engineering faculty, postdocs, and graduate students. Batelle, an independent nonprofit research and development organization, is managing the project under a contract with the Federal Highway Administration (FHWA).

"We were in a good position to undertake this kind of project," Cui said. "As one of the nation's leading hubs for transportation research, we have the capabilities needed to gather the information and build a platform for it. Our hope is that it will help support data-driven decision making among state and local authorities as well as the federal government."

Among the benefits: a ready way to assess the suitability of public-private partnerships (P3) for specific highway needs, as compared to traditional methods of project funding.

State transportation departments are increasingly turning to P3s to modernize and expand the nation's network of roads, bridges, rail, and ports. The financing model was also at the heart of the White House infrastructure proposal unveiled in 2018.

"One of our goals is to be able to document P3 performance in comparison with other kinds of projects," Cui said. "The database will provide inputs into the FHWA's Alternative Contracting Method toolkit, which is intended to aid state department of transportation officials in selecting the best-fit delivery methods for their highway projects."

With work on the database now complete, the next task is to inform stakeholders at all levels of government—including FHWA staff, state and local representatives, and other potential users—about the ways in which it can support their needs. "For those tasked with coming up with optimal transportation investment and financing solutions in their communities, having this database available will take some of the guesswork out the process," said Zhang, MTI director and Co-PI. "This, in turn, will have a positive impact on mobility, safety, and accessibility for all."

ADVANCED TOOLS & TECHNOLOGIES

IDENTIFYING HARD-TO-LOCATE HAZARDS

Following a spate of fatal incidents, including the death of a young Marine, Maryland joined several other states in deciding to remove all installations of a particular type of guardrail. Designed to absorb the shock of impact when struck, the units had repeatedly failed and instead penetrated the vehicles, maiming or killing drivers. But how could authorities quickly identify the more than 900 installations across the state? While cameras throughout the highway system provide images, sifting through them manually would be prohibitively time-consuming.

UMD Professor Yunfeng Zhang, an MTI faculty affiliate, is using machine learning techniques to help state authorities find and remove dangerous guardrails, but can also address other "needle in the haystack" problems—such as identifying areas prone to rock falls. A computer can sift through thousands of images, detect hard-to-see movements among the rocks and boulders located above a roadway, and compute the likelihood of a dangerous spill.

MTI APPOINTS DEB NIEMEIER AS CO-DIRECTOR

A leading expert on societal and environmental impacts of transportation networks and urban infrastructure has been tapped to co-lead the Maryland Transportation Institute (MTI) as the institute expands the scope of its research activities and impact.

Deb Niemeier. who is the inaugural Clark Distinguished Chair at the A. James Clark School of Engineering and a professor in the department of civil and environmental engineering, will advance new interdisciplinary MTI initiatives aimed at 1) establishing a DataLab at MTI that will facilitate research data sharing, data science research, and data-driven decision-making; 2) leveraging expertise from across campus to improve the multimodal transportation system and built environment; and 3) expanding existing MTI collaboration with partner universities in Maryland such as Morgan State University and University of Maryland, Baltimore.

"I look forward to working with MTI constituents to realize our shared vision— transforming MTI into an intellectual hub that promotes knowledge sharing and supports decision-making at federal, state, and local levels in collaboration with all our academic, government, and private-sector partners," Niemeier said.

"I am very excited that Professor Deb Niemeier will be taking on an important leadership role at MTI," said Lei Zhang, MTI founding director and Herbert Rabin Distinguished Professor of civil and environmental engineering at UMD. "Her experience in successfully leading interdisciplinary research initiatives and her ability to promote collaboration among MTI-affiliated researchers and centers are invaluable. I cannot wait to start working together to take MTI to a whole new level of innovation and impact."

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

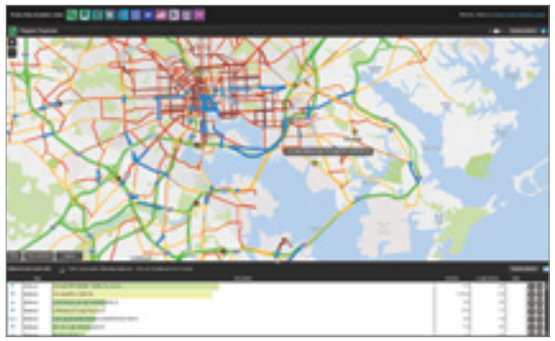
MTI AFFILIATED CENTERS AND LABS

- Bridge Engineering Software and Technology Center
- Center for Advanced Life Cycle Engineering
- 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

MTI UNIVERSITY PARTNERS

UNIVERSITY OF MARYLAND · MORGAN STATE UNIVERSITY · UNIVERSITY of MARYLAND BALTIMORE · FROSTBURG STATE UNIVERSITY

CENTER FOR ADVANCED TRANSPORTATION TECHNOLOGY LABORATORY



"MTI's rigorous, data-driven research helps us and other decision makers solve transportation problems."

JIM ROSAPEPE
MARYLAND SENATOR

The Center for Advanced Transportation Technology Laboratory—or CATT Lab—is the national brain trust of America's roadways, collecting, fusing, and analyzing more than eight billion measurements a day, including data from smart phones, roadside sensors, CCTV cameras, computer-aided dispatch systems, and weather stations. The largest big data transportation archive in the world, the CATT Lab was established after the 9/11 terror attacks, when it was clear that a real-time hub for transportation information was essential for first responders and government agencies. CATT Lab helps facilitate this highly coordinated effort, serving as common ground for jurisdictions and agencies to communicate, share data, collaborate, and learn best practices.

The heart of the CATT Lab is the Regional Integrated Transportation Information System, or RITIS, a suite of roughly 40 online analysis and visualization tools that help jurisdictions map and measure traffic conditions, plan for road improvements, predict and prepare for major weather events, and satisfy reporting requirements from the FHWA and other federal agencies. Work that would previously take hundreds of hours to complete can be shaved down to mere minutes.

Because RITIS monitors situations in real time, it has not only been a boon for planners and construction teams in managing work zones and maintenance, but also helps guide emergency response teams, transportation officials, and apps like Waze in the event of a significant accident. The system's long-range tools help jurisdictions pinpoint weak points in their transportation infrastructure to funnel money into the most pressing projects, and to visualize and measure congestion rates before and after road work. Trip data—the ability to see when, where, why, and how people travel—can now be captured through the Lab's Origin-Destination Analytics Suite, offering state and metropolitan agencies access to information essential to improving traffic safety, for the first time.

PROJECT MANAGEMENT CENTER FOR EXCELLENCE

From highway construction to airport management, the transportation field relies on skilled project management professionals for success. UMD's Project Management Center for Excellence is a leading resource for project managers at all levels, from those breaking into the field to experienced managers seeking to upgrade their skill sets or learn new strategies for tackling project challenges.

In addition to degrees and certificates, including an online Agile Project Management Professional Certificate program (available through edX) geared towards working professionals, the Center hosts an annual two-day symposium that features some of the leading coaches, mentors, and subject matter experts working in the project management field today.

"Transportation policymakers, planners, and engineers deal with complex projects that must be managed effectively to ensure success," says John H. Cable, the Center's director. "Through our courses, programs, and symposia, we've been able to build up a knowledge base and toolkit of best practices that those responsible for transportation projects, both large-scale and small, can utilize in order to meet project goals."

Transportation subject matter experts are frequent guest speakers at Center events. At the 2020 symposium, held virtually due to the COVID-19 pandemic, Omar Bashir of the RICS School of Built Environment highlighted risks that can undermine major transportation projects in urban areas. Using a monorail project in Mumbai, India as a case study, Bashir showed how time delays, cost overruns, and other problems severely compromised the success of the project, leading to low ridership and an eventual halt to the monorail service. Bashir's presentation highlighted "lessons learned" that are of potential importance to planners in other urban areas with responsibility for large-scale projects designed to reduce congestion and improve safety.

At a previous symposium, keynote speaker Dr. Karl Wunderlich, a corporate fellow for transportation analysis in Washington, D.C. and director of surface transportation systems at Noblis, discussed creating a system of automated and connected vehicles, highlighted some of the challenges associated with a "connected everything" environment, and mapped out four management strategies for thriving in this connected world.

"It's no secret that the transportation arena is undergoing huge changes driven by technological innovation," Cable says. "It's important for professionals in the field to anticipate the management challenges associated with these emerging technologies. That's why we encourage them not to think of project management as something secondary to their main career focus. In reality, it's a very significant component of the work that they do every day."

The Project Management Center for Excellence's next symposium is scheduled for April 22-23, 2021, and will also be virtual. The new online format has proved a success, allowing attendees from distant locations to attend without the cost or time required to travel. To learn more about the event, visit **go.umd.edu/pm2021**

UMD UNMANNED AIRCRAFT SYSTEMS TEST SITE

With applications that run the gamut from commerce to medical delivery, the unmanned aviation industry is on a rapid growth trajectory, one with many potential benefits for Maryland's economy. From its base in St. Mary's County, the UMD Unmanned Aircraft Systems (UAS) Test Site is helping to build a technology corridor that will provide a strong foundation for regional economic growth in the coming decades.

"We're change agents," says UMD UAS Test Site Director Matt Scassero. "The future of aviation is happening now. And it's happening here, in Southern Maryland."

Launched in 2014, the Test Site provides services that include consultation, needs assessment, airworthiness evaluation, testing and evaluation, and flight ops services. Customers served by the facility range from federal agencies such as NASA and NOAA to fledgling companies carving a niche in the unmanned systems market. In addition, many long-established firms in the aviation industry seek to pivot from manned to unmanned systems, and the Test Site is able to support them in this transition.

As with any emerging industry, stakeholders must keep abreast of an evolving regulatory environment and adopt best practices that will allow them to reap the benefits of unmanned flight while mitigating the risks. Providing such expertise is a major part of the Test Site's mandate; Scassero and his team not only are deeply knowledgeable about state, federal, and international rule-making, but helped draft relevant state legislation in Maryland. Drawing on trusted procedures used in manned aviation, the Test Site team has also developed a set of flight ops standards and practices intended to set the bar for the industry as a whole.

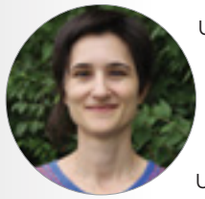
Meanwhile, UMD UAS Test Site engineers and pilots have already pioneered major breakthroughs in the use of UAS technology—including the first-ever drone delivery of a kidney for transplant into a waiting patient. This historic flight in April 2019 used a custom-built drone to transport the kidney from outside the Living Legacy Foundation's facility in West Baltimore, along a three-mile journey above the city's downtown, to a helipad atop the University of Maryland Medical Center (UMMC).

The successful organ flight generated worldwide headlines—and, more importantly, paved the way for future improvements in the way transplant organs are delivered. Current methods, which rely on commercial aircraft, are often fraught with delays that can render an organ non-viable before it ever reaches the patient. Using unmanned aircraft can potentially streamline the process and save lives.

"We're at the cusp of major transformation, not only in this area but in many others," Scassero said. "But it has to be done right. That's why we're here."

URBAN COMPUTING LAB

An average of 816 bicycle crashes occur in Maryland each year, with about 80% of these resulting in injuries or death. In D.C., the annual number of bicycle accidents stands at around 334. Transportation officials seek to reduce the risk, first by analyzing conditions that can lead to accidents, and then by taking steps to mitigate these conditions.



Up to now, though, agencies have been hampered by gaps in the data, says Vanessa Frias-Martinez, director of UMD's Urban Computing Lab, who holds dual appointments with the College of Information Sciences (iSchool) and the University of Maryland Institute for Advanced Computer Studies (UMIACS). Simply recording the number of crashes doesn't tell the entire story of bicycle safety: many crashes go unreported, particularly if those involved escaped injury.

To paint a more accurate picture, Frias-Martinez and her team at the UMD Urban Computing Lab devised a novel method to capture data on cycling conditions in Washington, D.C. First, the researchers partnered with the Washington Area Bicyclists Association (WABA) to obtain imagery taken by bikers carrying GPS-equipped cameras. The team then set up an online tool that gave cyclists the opportunity to watch cycling videos—created by stitching together the imagery and GPS data—and rating street segments in terms of safety, while also answering specific questions: is there a bike lane? Are there hazards such as ongoing construction or blind alleys?

The team collected over 2,000 ratings from cyclists and used these to train machine learning models that predict perceived cycling safety. The predictions were then used to create a map that color-codes streets green, yellow, or red in terms of perceived safety. "Transportation departments can then go to the red segments and take a closer look at why these areas are considered dangerous," Frias-Martinez explains. "And then they can decide what to do about it. Maybe changes need to be made to the infrastructure, or maybe driver behavior is the issue and we need to provide education. We're providing a more comprehensive view that does not rely solely on reported crash data." The research is currently focused on D.C., but could potentially be expanded to include Maryland and Virginia.

Transportation is one of three focus areas—the others are disaster management and socioeconomic development—at the lab, which has an overall mission of using digital footprints, including GPS and mobile phone data, to better understand behavioral patterns in urban environments.

MICHAEL BALL

SENIOR ASSOCIATE DEAN FOR FACULTY & RESEARCH
DEAN'S CHAIR IN MANAGEMENT SCIENCE

NEW TECHNOLOGIES HELP STREAMLINE INTERNATIONAL AVIATION

Despite the upheavals caused by the COVID-19 pandemic; long-term trends in the airline industry still point to increased growth and complexity, including a proliferation of carriers and routes. At the same time, new tools are making it possible to achieve greater precision and efficiency than ever before in managing air traffic, according to Michael Ball, senior associate dean and dean's chair in management at UMD's Robert H. Smith School of Business.

Ball holds joint appointments at UMD's Robert H. Smith School of Business—where he serves as senior associate dean for faculty and research and holds the dean's chair in management science—and at the Institute for Systems Research (ISR) at the A. James Clark School of Engineering. He is also co-director and principal investigator of NEXTOR, an eight-university consortium funded by the Federal Aviation Administration (FAA) to conduct research in aviation operations. The FAA renewed the consortium's funding in June 2020.

A key focus area for UMD's NEXTOR researchers has been the relationship between airlines and the FAA relative to operational decision making. Over the past several years a set of operational concepts, algorithms, and decision support tools have been incorporated into the U.S. National Airspace System based on Collaborative Decision Making (CDM) principles. Ball argues that both the airlines and the FAA must play a strong role in managing operations as each has specific information and each is most effective for certain control and management roles.

Bad weather or congested skies can prompt the FAA to impose delays. Rather than doing so arbitrarily, Ball said, it makes sense to involve the airlines to determine which routes are most important.

"Say you have two United flights trying to get to Chicago. One has fifty passengers and the other 200. Rather than delaying the first plane for 30 minutes and the second one for an hour, it might make sense to do it the other way around—that way you have fewer people waiting to take off. There can be a host of reasons why an airline might want to prioritize one flight over another. Only the airline has the information to make such prioritization decisions," he said.

In general, Ball said, aviation traffic flow management has come a long way—and new tools and technologies are making it possible to manage the skies with even greater precision.

"Globally, we're seeing how technologies like GPS-based navigation are creating much better awareness, allowing aircraft to become more autonomous and less reliant on air traffic controllers," Ball said. "New precision navigation systems increase the number of trajectories that a plane can use to get from point A to point B. Aircraft can fly very precise trajectories and these can, in some cases, be dynamically adjusted. These capabilities are increasing the capacity of the system."

In general, Ball said that "enhancements are being made around the world that will change the nature of what I do, which has to do with managing flows. They are changing the very nature of the air travel experience. And we're still in the early stages, with so much more to come."

ARIEL BIERBAUM

ASSISTANT PROFESSOR, SCHOOL OF ARCHITECTURE,
PLANNING & PRESERVATION

BUILDING A THEORETICAL FRAMEWORK FOR STUDYING LINKS BETWEEN TRANSPORTATION AND EQUITY IN EDUCATION

Most travel is done with a purpose. When the purpose is to advance our education—to get to the neighborhood school, or perhaps another school that could provide more opportunity—then the transportation options available can shape the course of our lives. Transportation is thus part of a broader conversation about education justice, says Ariel Bierbaum, assistant professor of urban studies and planning in the UMD School of Architecture, Planning and Preservation.

But most research to date has not connected the dots, Bierbaum notes. And that's in part because a well-developed theoretical framework across transportation and educational equity is not yet in place.

Together with colleagues Jesus Barajas at the University of California, Davis and Alex Karner at the University of Texas-Austin, Bierbaum is developing such a framework, one based on the concept of "mobility justice." In September 2020, the Journal of the American Planning Association published a paper detailing their work.

"Education researchers and practitioners are concerned about access to schools and high-quality education. But they're often puzzled by the physical transportation component and how that affects access," Bierbaum explains. "Being able to bridge these disciplines, both in research and practice, can help bring about more equitable conditions and outcomes in access to education."

Take Baltimore City, for example, where middle and high school students do not take school-provided yellow buses, but instead use public transportation. Baltimore's school system also has an open enrollment policy, meaning that students are not tied to their local neighborhood school but can instead travel to attend another. That can mean opportunities for some, but obstacles for others. Students may find that bus schedules don't align well with the school day, or that some buses are overcrowded and won't stop to pick them up. Some young people may experience harassment and threats to personal safety. In worst-case scenarios, tardiness, absenteeism, and failure to complete high school could be a result. Qualitative research, Bierbaum says, is needed to understand and tell the stories of the experience of different student populations, particularly students of color, as they go to and from school.

"If we think in terms of mobility justice, then we consider not only the ways in which access to travel is uneven across different sets of people, but also how travel to school is constructed rhetorically to reinforce particular kinds of representations or stereotypes about young people," Bierbaum said. "We can better understand and lift up the kinds of street-level or transit-level experiences that our most marginalized young people have."

"We're asking 'how can we think differently and more broadly about transportation as a means to an end?'," Bierbaum says. "That way we can ensure that we're really achieving that end, which is spatial and educational justice."

DEREK PALEY
WILLIS H. YOUNG JR. PROFESSOR OF AEROSPACE ENGINEERING EDUCATION
DIRECTOR, MARYLAND ROBOTICS CENTER
PROFESSOR, DEPARTMENT OF AEROSPACE ENGINEERING AND INSTITUTE FOR SYSTEMS RESEARCH
DIRECTOR, COLLECTIVE DYNAMICS AND CONTROL LABORATORY

PALEY WINS GRANT FOR MICROMOBILITY STUDY

As little as two years ago, e-scooters were a rare sight in the United States. Not so today. Their use has risen dramatically since 2018, spurred by rideshare services—like Bird, Lime, and VeoRide—that allow users to rent one quickly with the help of an app. But increased convenience and mobility are only one part of the story. The trend has also fueled concerns over problems ranging from rider injuries to irritated pedestrians.

Derek Paley, an A. James Clark School of Engineering professor whose many interests include autonomous vehicles, robotics, and group dynamics, believes rigorous, data-driven analysis is needed to more fully understand both the benefits and risks of e-scooters. With the help of an MTI Seed Grant, Paley has launched an ambitious research project that includes both lab tests and computer modeling.

One key area of focus will be the ways in which e-scooter users adapt to an urban infrastructure that was not built with such vehicles in mind.

"Scooters are in no man's land, in a sense," Paley explains. "They're not necessarily safe in the street, but don't belong on the sidewalk either." In this situation, rider and pedestrian safety can be impacted by factors such as the location of a rack or rental station; if users have to cross a pedestrian-heavy area to reach it, the risks of an incident increase.

In his seed grant research, Paley will be collaborating with Jae Shim of the UMD School of Public Health, with Shim setting up an experimental space equipped with an actual scooter and Paley creating computer models and simulations, and conducting data analysis. The two methodologies are a potent combination; while a lab-based human experimental setting can provide data on biomechanics and movement control, a simulation can help researchers investigate phenomena—such as group behavior or response to infrastructure—that are difficult to test in a lab.

It's a relatively new research avenue for Paley, whose home base is UMD's top ten-ranked aerospace engineering program, but one that aligns with his existing projects. As director of the Maryland Robotics Center, the Collective Dynamics and Control Laboratory, and the Autonomous Micro Air Vehicle Team at UMD, he has a longstanding interest in emerging technologies, the way they impact human behavior, and the potential to use computer models in order to better understand both.

These days, Paley not only studies e-scooters, but also uses them. Visit his office and you'll see a small, unicycle-like device with a convenient carrying handle—unlike a conventional unicycle, though, it doesn't simply tip over if you let it go. Paley uses this compact e-scooter to get around the large UMD campus, and he says it's been of tremendous benefit, cutting down on his commute time to classes and meetings, and providing exercise in the process. He's also found that the vehicle makes an excellent teaching tool, allowing him to demonstrate a number of aerospace engineering principles.

Though the difficulties of integrating such vehicles into the urban environment are very real, so are the benefits, he says—whether in terms of health, fitness, convenience, or reducing carbon emissions. Given his research background, it's no surprise that he's interested not only in riding e-scooters, but in scooters that may someday drive themselves.

"As an engineer, I think about different aspects of the technology, including the potential for automation," Paley says. "It's not such a big leap, since my students and I already work with quadrotors that fly themselves and underwater vehicles that don't need human pilots. We're already seeing interest in the possibility of self-driving scooters, tied into the scooter-share model. In the future, you may be able to open an app on your phone and have the scooter come and meet you."

"There's lots of room for innovation."

"Researchers at UMD and the Maryland Transportation Institute are drawing needed attention to the link between transportation policy and issues of equity and social justice."

JOSELINE PEÑA-MELNYK
MARYLAND REP.

BETTER, MORE RELIABLE TRANSPORTATION STATISTICS

Transportation researchers and policymakers have an abundance of data to work with, and the volume is growing each day. But simply having data available does not, in itself, lead to meaningful insights—tools are needed to interpret the numbers in ways that can support decision-making.

With the help of a Maryland Transportation Institute Seed Grant, two UMD professors—Cinzia Cirillo of the Department of Civil and Environmental Engineering and Partha Lahiri of the mathematics department and the Joint Program in Survey Methodology—are demonstrating how Bayesian statistics can be used to parse a wide variety of transportation-related data.

Their joint research project, A Bayesian Data Science Methodology for Transportation Statistics at Granular Levels, was among six selected during the first round of MTI Seed Grants, announced in late 2018.

"We're interested in all kinds of transportation data," Cirillo explains. "That can include the National Household Transportation Survey, the American Community Survey, census data, or even income data from the IRS. The goal is to develop a tool that researchers can use to harness data from all these sources and apply it to a research problem."

Using Bayes' Theorem, named after the 18th-century English statistician and philosopher, statisticians can systematically update information as new evidence comes in. "Simply put, Bayesian statistical methodology draws its strength from multiple structured and unstructured big data sources, and quantifies the associated uncertainties. It has great potential for providing reliable transportation statistics," Lahiri said.

"Policymakers grapple with the problem of how best to evacuate people from low-income areas during an emergency or disaster. With our method, we're not only able to pinpoint the locations of low-income individuals very precisely at the level of census tracts, but also identify which individuals do not own cars and need to be picked up."

By using Bayesian tools, Cirillo said, researchers can better assess the amount and type of information contained in data sets, such as surveys, as well as the kinds of predictions that can be made.

"For example, policymakers grapple with the problem of how best to evacuate people from low-income areas during an emergency or disaster," Cirillo said. "With our method, we're not only able to pinpoint the locations of low-income individuals very precisely at the level of census tracts, but also identify which individuals do not own cars and need to be picked up."

A similar approach, she said, has been applied to issues such as traffic congestion—for example, by producing more accurate estimates of travel times. Cirillo and Lahiri have already received recognition for prior work in this area, having co-authored an award-winning paper that analyzed traffic patterns and used them to project future trends.

The MTI Seed Grant program is expressly designed to foster such collaborations, reflecting a growing awareness that interdisciplinary work is not only desirable, but essential, Cirillo said.

"Increasingly, the issues we're looking at in transportation and, indeed, in many other fields, cannot be addressed without strong interdisciplinary collaboration," she said. "That hasn't always been the norm in academia—but the paradigm is changing. And MTI is helping to spearhead that change."

"In an age of evidence-based policy making, demand for reliable statistics at granular levels is steadily increasing," Lahiri said. "Statistical methodology is increasingly playing an important role in helping scientists design experiments and analyze complex data. Our collaborative work, using Bayesian methods to provide reliable statistics at granular geographical levels, is thus very timely."

"Moreover, it can be applied to other scientific and engineering fields as well."

PHOTO BY: LT. ZACHARY WEST

APP DEVELOPED AT MTI REWARDS USERS FOR SMART TRAVEL CHOICES

Following a successful pilot program, a new traveler incentive app developed by MTI researchers received its official launch in August at the National Press Club in Washington, D.C. The project is a joint initiative of MTI, the Metropolitan Washington Council of Governments (MWCOG), National Capital Region Transportation Planning Board (TPB), and the Commuter Connections Program, with funding from the U.S. Department of Energy's Advanced Research Projects Agency-Energy (ARPA-E).

The app, incenTrip, provides monetary and non-monetary incentives to improve commuter trips and reduce traffic congestion, energy use, and emissions. It not only recommends alternative departure times and travel routes, but provides personalized travel rewards points when users opt for greener mode choices such as carpooling, mass transit, walking, or biking.

Combining artificial intelligence of individual user preference with real-time prediction of transportation system dynamics, incenTrip learns its users' travel patterns, allowing it to make individually-tailored recommendations. Together, incenTrip's features add up to a powerful, cost-effective way to influence travel behavior, said Herbert Rabin Distinguished Professor Lei Zhang, MTI's director.

The goal, Zhang explained, is to provide an effective tool to incentivize behavior changes. "If we can nudge just a small percentage of travelers to use alternative modes of transportation, change their travel time, and make smarter routing/driving choices, we can accomplish significant system-level benefits," he said.

Indeed, the data shows that small changes in travel patterns can have an outsized impact on congestion—as demonstrated by Pope Francis's 2015 visit to Washington, D.C. As reported by *The Washington Post*, a 2% reduction travel demand during the Pope's visit led to a 27% drop in peak period congestion.

incenTrip "constantly seeks to improve the travel experience without requiring users to do the heavy lifting in searching for better options," said Transportation Planning Board Chairman and Prince William County Supervisor Martin Nohe. Established habits can be hard to break, Nohe said, but the rewards baked into incenTrip can provide the extra impetus needed to make changes.

Other launch event speakers included Kelly Russell, vice chairwoman of the Transportation Planning Board and alderwoman of the City of Frederick, and Jack McDougle, president and CEO of the Greater Washington Board of Trade. ARPA-E Deputy Director for Technology Patrick McGrath also attended the event as the ARPA-E leadership representative.

"The next step for incenTrip is to scale up and assist more states, cities, and employers to promote smarter and greener travel choices by leveraging the latest big data, artificial intelligence, and computing technologies in incenTrip," Zhang said. "We want to work closely with our existing and new government agency partners and private-sector employers to expand the incentive program, so we can together make a bigger impact in relieving congestion and reducing energy use and emissions."

Download incenTrip on **Google Play** and the **Apple App Store**, or visit **incentrip.org**.

MTI'S XIONG WINS YOUNG RESEARCHER AWARD FOR WORK ON INCENTRIP

A UMD researcher who helped develop a smartphone app that incentivizes smart travel choices has won recognition from the International Association of Public Transportation (UITP).

MTI Assistant Director for Transportation Modeling Research Chenfeng Xiong, who holds joint appointments at the UMD Department of Civil and Environmental Engineering and the University of Maryland, Baltimore's Shock Trauma and Anesthesiology Center (STAR), won the Young Researcher Award for his work on incenTrip, a smartphone app technology that uses personalized, real-time multimodal traveler information and incentives to influence daily commutes and reduce congestion in Washington, D.C. and Baltimore.

His work leverages the latest big data, machine learning, and computing technologies to optimize travel behavior for reduced congestion, energy use, and emissions in a cost-effective way.

"Nudging people's travel behavior is a difficult task, even with the advanced and amazing technology readily available," Xiong said. "Nowadays, big data, A.I., and 5G connectivity are already changing people's daily life dramatically. But if we aim to persuade more people to travel using public transportation and advocate for it, the technological aspect needs to be integrated organically with its psychological counterpart."

"With incenTrip, we hope to engage more people with incentives, gamification, and more behavioral nudging. It is a start, and could lead to a very cost-effective solution to congestion plaguing the United States," Xiong said.

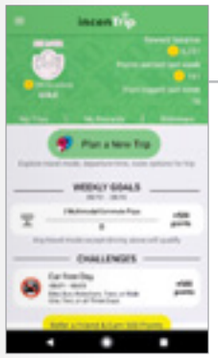
UITP meets just once every two years to celebrate and acknowledge the most ambitious and innovative public transportation projects from around the world.

At the 2019 UITP Congress held in Stockholm, researchers had the opportunity to compete for the following awards:

- Design processes and products
- Diversity and inclusion
- Marketing campaign
- Multimodal integration
- Operational and technological excellence
- Public and urban transport strategy
- Smart funding, financing, and business models
- Young researchers

The award competition received over 400 proposals. This pool was further narrowed to 31 finalists by an international jury of experts and then published prior to the UITP Congress. The winners were then announced during the closing ceremony of the summit.

Xiong earned his Ph.D. in Transportation Engineering from the University of Maryland in 2015. His research interests include understanding the fundamentals of transport systems, including travelers' choices, transport economics, representative agents, and their roles in designing smart-city and smart mobility solutions.



"The next step for incenTrip is to scale up and assist more states, cities, and employers to promote smarter and greener travel choices."

UMB, UMD TEAM UP FOR TRANSPORTATION AND HEALTH RESEARCH

ALAN FADEN, DAVID S. BROWN PROFESSOR IN TRAUMA, UMD OF MEDICINE

Incentivizing safer behavior among drivers, reducing the number of crash-related injuries and fatalities, and getting patients to emergency care more quickly were among the key concerns discussed at the University of Maryland, Baltimore (UMB)/University of Maryland Bi-campus Transportation and Health Workshop in November 2019.

MTI and UMB's Center for Shock Trauma and Anesthesiology Research (STAR) jointly organized the workshop, which is part of a broader collaborative effort between UMB and UMD.

STAR, designated as an organized research center at the University of Maryland School of Medicine in 2007, is the first research center in the nation dedicated exclusively to the study of trauma, its complications, and prevention.

Such collaboration "is exactly what we should be doing" to leverage expertise at the two institutions," said UMD Provost Mary Ann Rankin, who spoke at the event along with her UMB counterpart, Provost and Executive Vice President Bruce Jarrell.

The event brought together transportation engineers, trauma care specialists, and highway safety officials to discuss how cutting-edge research and analytical tools—including the world's largest transportation database, hosted at UMD's Center for Advanced Transportation Technology (CATT) Lab—can help improve safety and quality of life in Maryland and beyond.

State officials at the workshop stressed the applicability of new research and tools to the real-life transportation and safety issues that Marylanders face, including the risks posed by behaviors such as distracted and impaired driving.

"We want to be able to take what you find and tie it in with what we can do to reduce driving fatalities and injuries in the state," said Tim Kerns, director of Maryland's Highway Safety Office.

BIG DATA IN ACTION FOR CONGESTION RELIEF

Using transportation system data and mobile device location data from public- and private-sector partners, MTI experts have developed person and freight travel origin-destination information for the entire U.S. and for all transportation modes. This comprehensive transportation demand information helps decision makers and agency staff understand travel behavior and needs for different communities and socio-demographic groups, and make smart investment decisions to meet current and future travel demands.

Working closely with local, state, and federal agencies, MTI researchers and software developers analyze large data streams from sensors and probe vehicles, as well as from police accident records and other databases. More than 40 data analytics tools enable agencies and communities to monitor transportation system performance; identify congestion bottlenecks and causes of traffic congestion; estimate the cost of congestion to person and freight movement; and support congestion relief solutions such as integrated corridor management, travel demand management, transportation systems management and operations, advanced traveler information systems, incident response, advanced traffic control and optimization, and connected vehicles and infrastructure.

A major focal point at the workshop was the massive growth in available data, as well as the development of new tools for analyzing that data.

MARYLAND TRANSPORTATION INSTITUTE ANNOUNCES SEED GRANT WINNERS

MTI announced its second round of seed grant awardees in late 2018. The program is designed to spur collaborative, interdisciplinary research across multiple colleges at UMD.

This year's winning proposals cover a wide range of transportation-related topics, including environmental policy analysis, electric scooter mobility, and communications technology that can assist vulnerable road users.

MTI's co-director, Herbert Rabin Distinguished Professor of Civil and Environmental Engineering Lei Zhang, extended his congratulations to the awardees—and encouraged others to try again next year.

"The MTI Seed Grant program provides a great opportunity not only to conduct research that has tangible human and societal benefit, but to explore the applicability of emerging fields such as machine learning and artificial intelligence in addressing transportation needs," Zhang said.

"Once again, we're excited to see UMD faculty putting forward proposals that advance the field and engage bold new approaches to transportation research," he said. "That's very much what MTI is about."

Through the seed grants, MTI aims to spur collaborative projects that bring together transportation researchers across colleges at UMD to conduct innovative research with broad societal and economic impact. In addition, the grant program is intended to yield at least one major external funding proposal.

2020-21 SEED GRANT AWARDEES

Anna Alberini, CoPIs: **Cinzia Cirillo**, **James Archsmith**
"Developing Analytical Tools for Environmental Policy Analysis: the Case of Household Vehicles, Fuel Economy, and Vehicle-Miles Traveled"

Dimitrios Goulias, CoPI: **Mark D. Fuge**
"Data Mining in Transportation Geomaterials & Infrastructure Health Monitoring Through Machine Learning"

Derek Paley, CoPI: **Jae Kun Shim**
"Research in Electric Scooter Mobility"

Kaveh Farokhi Sadabadi, CoPI: **Nirupam Roy**
"Dedicated Short Range Communications (DSRC) Key Fob for Vulnerable Road Users (VRU)"

Paul Schonfeld, CoPI: **Ilya Ryzhov**
"Methods for Evaluating, Selecting, and Scheduling Interrelated Alternatives for Network Development"

MARYLAND TRANSPORTATION INSTITUTE LECTURES AND SEMINARS

CYNTHIA CHEN

University of Washington Professor of Civil and Environmental Engineering Cynthia Chen presented a two-part seminar at MTI in June 2019, highlighting the promise of emerging data for transportation applications.

At UW, Dr. Chen directs the Transportation Human Interaction-and-Network Knowledge (THINK) lab, where she and her students research the sustainability and resilience of a city through the lens of human interactions with physical infrastructures and the built environment. The work of THINK lab is highly interdisciplinary, drawing on the latest methods and ideas in disciplines from social and natural sciences to engineering.

Chen is also associate director of the USDOT-supported TOMNET (Teaching Old Models New Tricks) Center and associate editor of *Transportation*.

PATRICIA HU

MTI welcomed Patricia Hu, associate administrator and director of the U.S. Department of Transportation's Bureau of Transportation Statistics, to the UMD campus in September as part of its Distinguished Seminar Series. Hu provided an overview of the Bureau, including its scope and purpose, and identified several key areas in which BTS carries out Congressionally-mandated research. These include transportation performance and impact, intermodal movement of people and goods, air travel, transportation safety, and the transportation sector's contribution to the economy.

BTS is not a policy-making organization, Hu stressed during her talk. Rather, it is policy-neutral and must adhere to an objective, non-biased approach to the data it gathers. "Whatever we observe, we publish," she said.

Hu has served as director of BTS since 2011. In this role, she serves as the U.S. DOT secretary's senior advisor on data and statistics, and is responsible for directing a federal statistical agency to enhance the relevance, quality, timeliness, accessibility, and availability of transportation statistics and information to inform transportation decisions.

MORTEZA FARAJIAN

Morteza Farajian, executive director of the Build America Bureau at the U.S. Department of Transportation, delivered an MTI Distinguished Seminar on October 31, discussing ways to facilitate investment in U.S. transportation infrastructure through innovative financing and project delivery models.

Farajian took up leadership of the Build America Bureau in April 2019. Earlier, he served as acting deputy secretary of transportation and was director of public-private partnerships at the Virginia Department of Transportation.

The bureau headed by Farajian spearheads transportation infrastructure development projects across the United States. It serves as the single point of contact and coordination for states, municipalities, and project sponsors looking to utilize federal transportation expertise, apply for federal transportation credit programs, or establish public private partnerships.

In addition to facilitating credit and grant opportunities, the Bureau provides technical assistance and promotes best practices in project planning, financing, delivery, and monitoring.

MICHAEL PACK

Center for Advanced Transportation Technology (CATT Lab) director Michael Pack delivered a seminar at MTI on November 2019, detailing ways research can utilize the data gathered by his organization. Complete with visuals and graphics illustrating the work done at the CATT Lab, Pack's talk demonstrated how the Lab's tools and technologies can assist researchers and Department of Transportation policymakers as they study a wide range of transportation-related issues.

Pack also provided a sneak peek into the latest big data technologies being developed for the next generation of traffic operators and planners—including technologies that utilize connected and autonomous vehicles.

DIANA FURCHTGOTT-ROTH

As part of the Maryland Transportation Institute's Distinguished Seminar Series, Diana Furchtgott-Roth, deputy assistant secretary for research and technology at the U.S. Department of Transportation (USDOT), presented a seminar on the Department's initiatives and priorities. Her presentation covered topics ranging from rideshare to automated and connected vehicles.

Throughout her career, Furchtgott-Roth has sought to promote innovation in America's transportation system and lower barriers to the development of new technology. Prior to joining USDOT, she was acting assistant secretary for economic policy at the U.S. Department of Treasury. She has been a senior fellow and director of Economics21 at the Manhattan Institute for Policy Research and an adjunct professor of economics at The George Washington University. She previously served as chief economist of the U.S. Department of Labor; chief of staff of the President's Council of Economic Advisers; deputy executive director of the Domestic Policy Council; and junior staff economist at the Council of Economic Advisers. Ms. Furchtgott-Roth is the author of five books and was a columnist for *MarketWatch.com* and *Tax Notes*.

STEVE CROCKER

Internet pioneer Steve Crocker began his March 2020 Distinguished Seminar with a quote from zoologist J.B.S. Haldane's *On Being the Right Size*. "A large change in size inevitably carries with it a change of form," Haldane wrote—words applicable not only to zoology but to the internet's WHOIS system. A key part of the domain registration system, WHOIS, Crocker notes, dates back to the much tinier internet of the 1980s, when its users were mainly researchers and specialists, and privacy concerns were few. WHOIS was never intended to serve a sprawling, global network of the kind that has since emerged, Crocker noted, and the strains have been tangible. Longstanding concerns over privacy came to a head recently with Europe's implementation of the General Data Protection Law (GDPR), which spurred an abrupt reduction in the availability of WHOIS data.

Crocker, who is chair of the ICANN Board of Directors, described ongoing efforts to develop a more balanced and effective policy that is both consistent with the emergent privacy laws and the needs of today's internet.

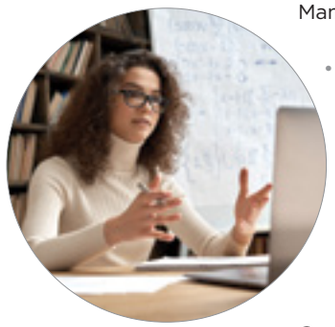
Involved in the internet since its inception, Crocker now heads the internet research and development company Shinkuro, which builds tools for cooperation and collaboration.

EDUCATION AND WORKFORCE DEVELOPMENT PROGRAMS

The University of Maryland offers a wide range of transportation education and workforce development programs, including degree programs, a joint internship program, certification programs, professional training courses and workshops, and a webinar series.

EDUCATION PROGRAMS

- Ph.D. in Transportation Engineering, Urban Planning, and other transportation-related fields
- Master of Science in Engineering, Planning, Economics, Supply Chain Management, and other transportation related fields
- Master of Engineering
- Master of Public Policy
- Master of Professional Studies
- Bachelor's degree in Civil and Environmental Engineering with the option for a transportation and project management focus
- Certificate in Traffic Engineering Operations
- Consortium for Innovative Transportation Education (CITE) Certificates



CONSORTIUM FOR INNOVATIVE TRANSPORTATION EDUCATION

The Consortium for Innovative Transportation Education (CITE) is part of the Center for Advanced Transportation Technology and stands as a unique organization of university and industry.

CITE furthers the goals of safety and reliability in the transportation system through training and education with both academic and industry partners. CITE provides transportation engineering students and professionals with an integrated curriculum covering a wide range of topics related to Intelligent Transportation Systems (ITS)—from information technology to performance management.

CITE offers five certificate programs and more than 30 online courses to increase the number of transportation management and operations professionals. It also partners with the Institute of Transportation Engineers (ITE) to provide professional development opportunities.

PALS—PARTNERSHIP FOR ACTION LEARNING IN SUSTAINABILITY

Established in 2013, the University of Maryland Partnership for Action Learning in Sustainability (PALS) is a campus-wide initiative that pairs faculty expertise and student ingenuity to tackle a variety of sustainability-related issues facing Maryland communities, such as urban revitalization, stormwater and solid waste management, public health, and economic development. To date, the program has engaged six counties, four of the state's largest cities, and several community associations, providing over four million dollars in project value.

PALS has partnerships with 11 colleges and schools and has sponsored over 125 projects statewide.

> **"The way we get around is changing. We need new research paradigms in order to understand and address 21st-century transportation challenges. That's what I see MTI as providing."**
>
> CORY MCCRAY
> *MARYLAND SENATOR*

STUDENT AND ALUMNI STORIES

RACHEL TILLINGHAST

When counties and municipalities make plans to invest in bike lanes or pedestrian walkways, they must consider how many people are likely to use the new infrastructure. Until now, such projections have relied on distance. A particular location—such as a school, office park, or mass transit hub—might be chosen as a destination of origin and then placed at the center of a 3-4 mile radius.

But what if distance isn't the only variable affecting levels of use? "For a biker or pedestrian, the shortest or most direct route isn't always the best route," explains Rachel Tillinghast, a master's degree student in the urban planning program. "People might not feel comfortable with a bike path that involves super-hilly terrain, for instance." Working under the direction of MTI faculty affiliate Hiroyuki Iseki, Tillinghast and fellow student Devin McNally demonstrated a more precise methodology for measuring accessibility, incorporating perceptions of difficulty as well as bike infrastructure level of service. The result is a more nuanced view that can help transportation planners in quantifying the impact of improvements.

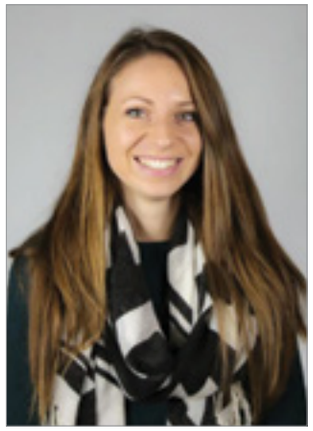
Tillinghast and her coauthors presented their findings in January at the Transportation Research Board's 2020 annual meeting in Washington, D.C. Having wrapped up her master's degree coursework, Tillinghast is now an intern with a leading crisis and emergency management firm, Witt O'Brien's, and plans to continue exploring issues related to land use.

NNEOMA UGWU

"Transportation engineers are not only problem solvers but also architects of the future," says transportation engineering Ph.D. student Nneoma Ugwu, whose research is focused on developing electric vehicle parking and charging systems that can incentivize the shift from gas to EV, and thus help address climate change. Among her current projects: a study of electric vehicle parking and charging behavior on the University of Maryland campus, intended to assist in developing the needed infrastructure.

Ugwu credits her background with sparking an interest in the transportation field: growing up in Nigeria, she often found herself wondering about ways to fix the country's transportation and traffic problems, including high levels of congestion and a failing road infrastructure. Her father, also an engineer, encouraged her to approach these problems analytically in order to devise practical solutions.

Beyond her current work on EVs, Ugwu has a broader interest in transportation planning and policy (TTP). "TTP is the future and I am passionate about creating sustainability designs, plans, and policies that foster growth and development for our community," she says. "Transportation connects people and businesses and is directly related to the growth of a nation and economy. Therefore, it's important to think long-term for our future, and not just focus on the present."



HANNAH YOUNES

With a childhood that alternated between Baltimore and Paris, France, UMD doctoral candidate Hannah Younes had many opportunities to notice the differences in how people on the two continents choose to get around. In Europe, most people see public transportation as a convenient and affordable option for day-to-day travel, whereas in the United States people generally go by car.

Thinking about these differences, and their implications for the environment, spurred Younes to choose a college major in environmental science with a focus on transportation. Since her undergraduate days, she has continued to explore issues of sustainability and equity as they relate to transportation networks. Not only that, she's helped make a tangible difference: in 2016, only one year after college graduation, she assisted the Maryland Transit Administration in developing a General Transit Feed Specification designed to improve accessibility.

Younes's current doctoral work spans two departments—geographical sciences and civil engineering. As a graduate research assistant at MTI, she has published papers on low-carbon micromobility during times of disrupted transit, as well as hurricane evacuation procedures and their impact on vulnerable communities. The scope and quality of her work has already brought her significant recognition: in January, she was selected by the Urban Mobility & Equity Center as a University Transportation Center Outstanding Student of the Year.

"Today, transportation is one of the most polluting sectors in the world," Younes said. "Innovative research is required to help reduce emissions and education is paramount in promoting sustainable transportation. My aspiration is to become a professor and a researcher and help achieve these goals."

"MTI has resources available that you won't find anywhere else, and its researchers are helping to reshape the transportation field in new and exciting ways."

MARC ELRICH
MONTGOMERY COUNTY EXECUTIVE

"MTI is harnessing the power of collaborative research at the University of Maryland by bringing together experts from multiple disciplines to address 21st-century transportation challenges. The solutions being developed at MTI are innovative, practical, and reflective of UMD's long tradition of advancing knowledge in critical fields."

MARY ANN RANKIN
SENIOR VICE PRESIDENT AND PROVOST, UNIVERSITY OF MARYLAND

MTI by the Numbers

20 affiliated **centers** and **labs**

>$10 BILLION
data records collected, fused, and analyzed daily by the **nation's largest transportation data center**

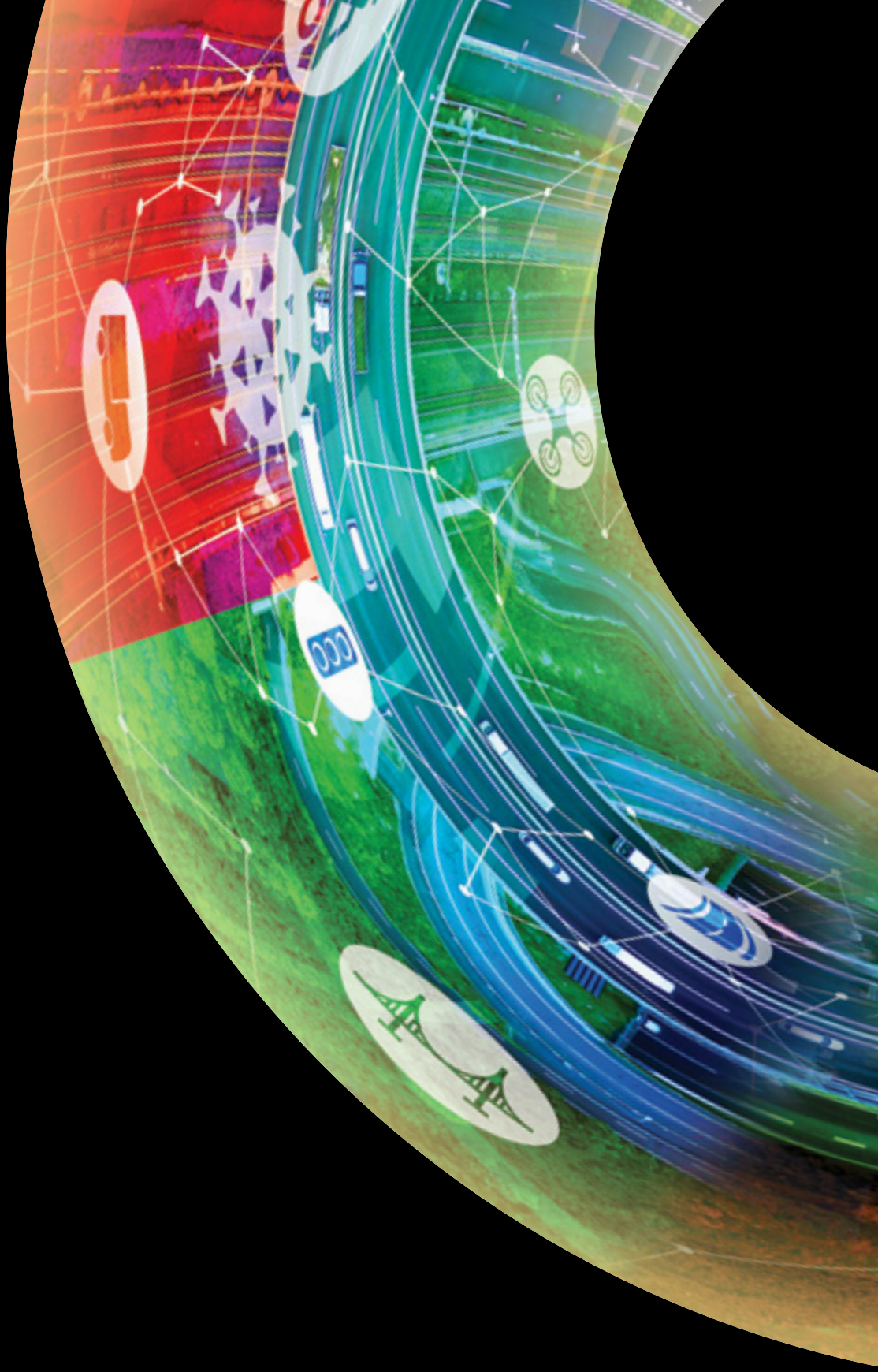
Support for hundreds of **student researchers** each year

>$25 MILLION
in **active research awards** during FY20

>120
affiliated faculty from 10 UMD colleges and schools

The Bottom Line

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



MARYLAND
TRANSPORTATION
INSTITUTE

1173 GLENN L. MARTIN HALL
4298 CAMPUS DRIVE
COLLEGE PARK, MD 20742

EMAIL: REQUESTS-MTI@UMD.EDU

MTI.UMD.EDU