

2018
CARTEEH
Biennial
REPORT



Center for Advancing Research in
Transportation Emissions, Energy, and Health
A USDOT University Transportation Center

Director's Message

Air pollution is a major environmental risk, responsible for millions of premature deaths worldwide. As a huge contributor to air pollution, the transportation sector is also grappling with the impacts of disruptive technologies and changing mobility patterns worldwide.

The areas of health and transportation are converging, and there is a paradigm shift in how emissions-related health issues are addressed, moving toward multidisciplinary collaboration and an integrated approach to solutions.

The Center for Advancing Research in Transportation Emissions, Energy and Health (CARTEEH) is a Tier 1 University Transportation Center with a research focus on the impact of transportation emissions on human health. CARTEEH is a unique consortium that brings together experts from the fields of transportation and public health. We comprise five universities spanning the United States, each with unique and complementary research capabilities. We advance research on transportation emissions in a more comprehensive manner, covering the holistic tailpipe-to-lungs spectrum, from transportation emissions to exposure and health impacts.

CARTEEH's goals are to conduct impactful research, support higher education and workforce development, and promote meaningful technology transfer. This biennial report highlights some of our activities and achievements over the first two years since CARTEEH's inception, as we have conducted innovative research, mentored wonderful students, and received recognition from the community of transportation researchers and professionals. I am proud of what we have achieved in this time, which is a testament to the incredible individuals who are a part of the CARTEEH team.

CARTEEH will continue to provide leadership in transportation research, education, and technology transfer in the emerging area of transportation and health. I encourage our stakeholders to contact me directly, whether it is to learn more about our work or to discuss emerging issues and problems that we can solve together.

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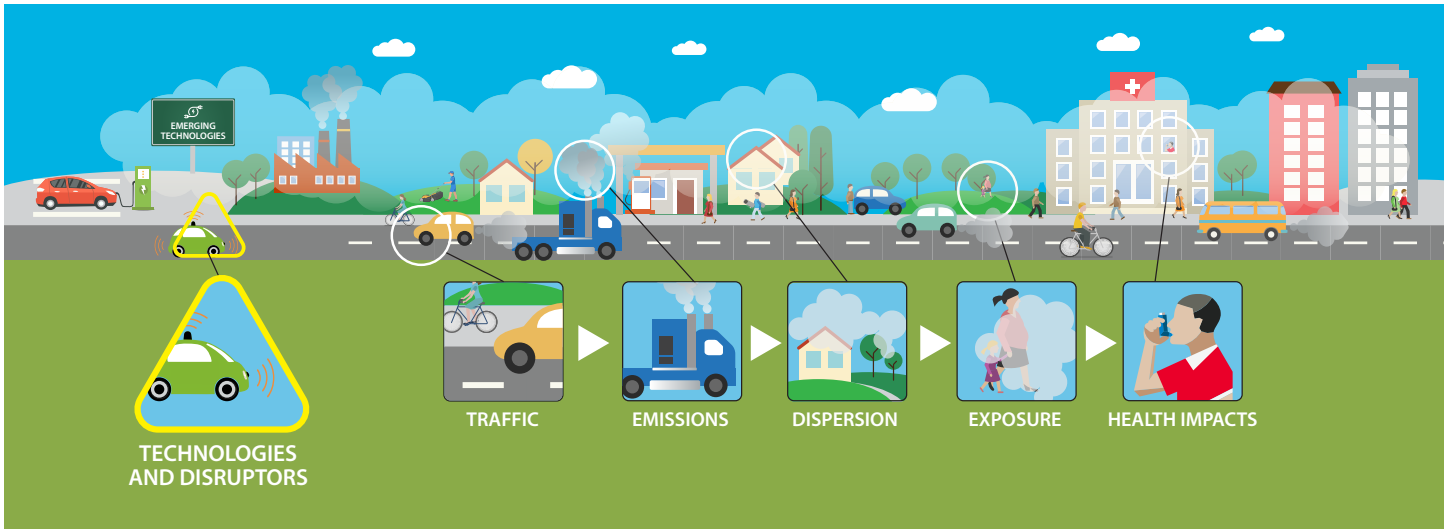


Sincerely,
Josias Zietsman, Ph.D., P.E.
Center Director

Our Vision

"CARTEEH is a premier University Transportation Center where transportation and public health experts work together to address the impact of transportation emissions on human health."

CARTEEH's goals are to conduct impactful research, support higher education and workforce development, and promote meaningful technology transfer.



Center Mission

The Center for Advancing Research in Transportation Emissions, Energy, and Health (CARTEEH) focuses on a matter of global importance—the impact of transportation emissions on human health. Air pollution is often termed as the silent killer. The World Health Organization estimates that outdoor air pollution was responsible for 7 million annual premature deaths in 2014, with air pollution being the biggest single environmental health risk and the cause of one in eight deaths worldwide. Among the different air pollution sources, transportation is a major contributor.

Transportation emissions can affect individuals in a variety of ways—from long-haul truck drivers who are exposed to emissions in the cabs of their trucks, to children whose schools are immediately adjacent to high-traffic areas such as freeways.

CARTEEH brings together experts from two disciplines that have not traditionally worked together — transportation and public health. Members of the CARTEEH consortium strongly advocate for advancing research on transportation emissions in a more comprehensive manner, mapping the holistic tailpipe-to-lungs spectrum, which includes the impact of transportation emissions on the environment and public health.

**CARTEEH
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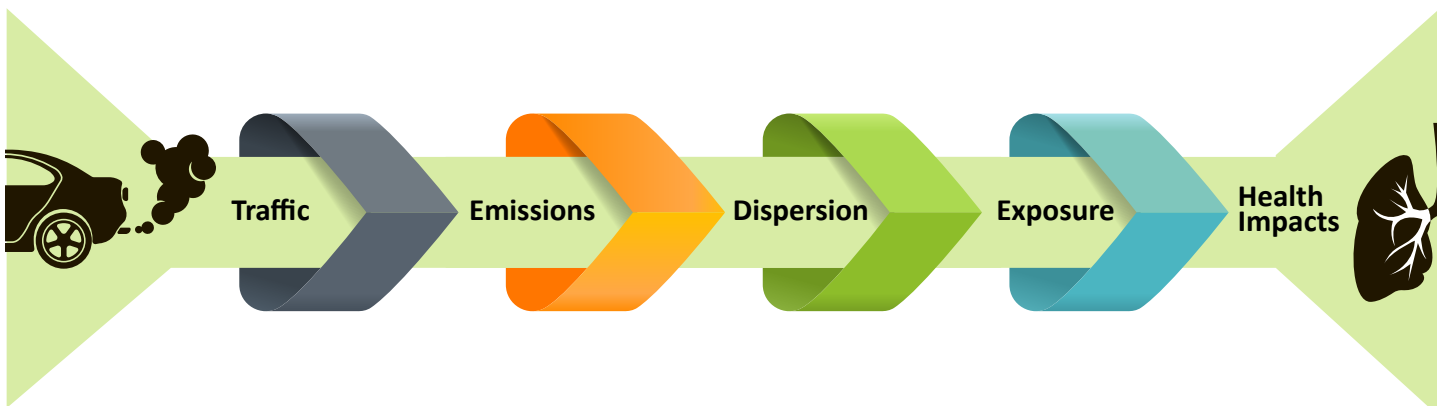
The Consortium

The Texas A&M Transportation Institute (TTI) leads the CARTEEH consortium consisting of itself and four partner universities. Each member brings unique strengths and national-level expertise, creating a consortium that spans multiple disciplines and fosters high quality, impactful research.

TTI is the largest university-based transportation research center in the United States, with expertise in all areas of transportation. The TTI researchers at CARTEEH have expertise in the measurement and modeling of transportation emissions, supplemented by broader experience with transportation systems, planning and policy, and assessment of emissions exposure and health impacts. As the leading educational institution in the area of public health in the United States, Johns Hopkins University (JHU) researchers address the impacts of emissions on public health through

Each member brings unique strengths and national-level expertise, creating a consortium that spans multiple disciplines and modes, and fosters high-quality, impactful research.

The Consortium



advanced risk-assessment and exposure assessment methods. Georgia Tech (GT) brings a broad portfolio of environmental and air quality research including large-scale modeling of transportation systems and their emissions and energy impacts. The University of Texas at El Paso (UTEP) focuses on air quality monitoring and modeling, and exposure and risk assessment. University of California, Riverside (UCR) focuses on quantifying and measuring emissions and sustainable transportation and has a range of laboratory facilities and traffic modeling and simulation capabilities to support this research.

The combined expertise of the CARTEEH consortium covers each aspect of the tailpipe-to-lungs spectrum of the impact of transportation emissions on human health.

CARTEEH is a premier University Transportation Center where transportation and public health experts work together to address the impact of transportation emissions on human health.

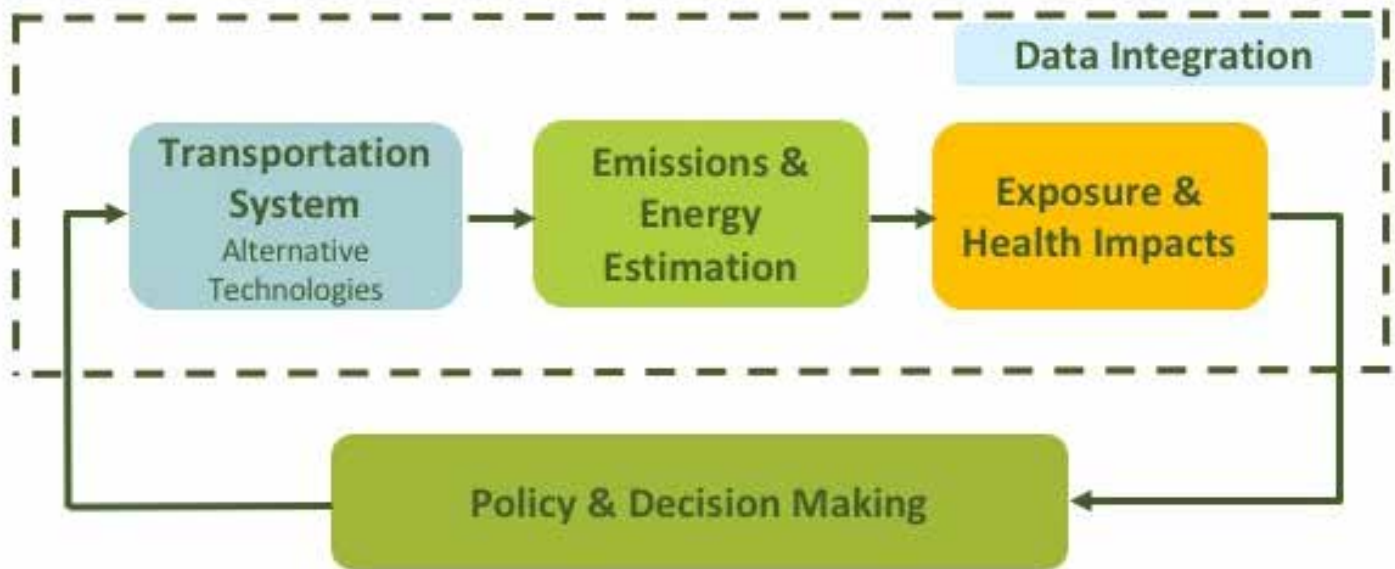
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carteesh@tti.tamu.edu
and we'll add you to our mailing list.

VISIT TTI
SOCIAL MEDIA





Research Focus Areas

- **Alternative Technologies** – how technological advancements (including in vehicle, engine, and fuel technologies) affect transportation emissions and their implications from a public health perspective.
- **Emissions and Energy Estimation** – enhanced modeling and measurement of transportation emissions and energy consumption, and the implications for air pollution and public health outcomes.
- **Exposure Assessment and Health Impacts** – how exposure to transportation emissions affects public health (including specific population groups or occupations) and how these impacts can be mitigated.
- **Policy and Decision Making** – understanding how energy policy and air quality regulations affect green house gas emissions, criteria pollutant emissions, and public health outcomes.
- **Data Integration** – exploring the application of integrated data sets from various disciplines for improving policy, decision-making, and health outcomes.

YEAR ONE Cooperative Research Projects

The emphasis of CARTEEH’s year one research program was on six cooperative research projects. Each project addressed one or more of the CARTEEH focus areas and was strategically chosen to leverage the strengths of each CARTEEH partner institution. All projects required collaboration among multiple partners, with the majority involving three or more institutions.

Year One Research Projects

Project	Lead Institution	Principal Investigators	Partner Institutions
<p><i>Transportation Emissions and Health Data Hub (#01-01)</i></p> <p>Reconciles differences in characteristics of transportation and health data, and develops a platform to house data sets and link to relevant information related to transportation emissions and public health data.</p>	TTI	Dr. Andrew Birt Dr. Dan Seedah	All
<p><i>Truck Emissions Exposure Study in Ports (#01-02)</i></p> <p>Assesses pollutant emissions at selected major ports and evaluates the potential reduction of exposure that can come from using alternative fuel and powertrain technologies for trucking operations at the ports.</p>	GT	Dr. Michael Rodgers	UCR, TTI
<p><i>Border Crossing Emissions Impact Study (#01-03)</i></p> <p>Characterizes the emissions impact of border crossings in El Paso and identifies the population groups most affected by the emissions.</p>	TTI	Dr. Tara Ramani Dr. Natalie Johnson	UTEP, JHU
<p><i>Healthy Living and Traffic-Related Air Pollution in an Underserved Community (#01-04)</i></p> <p>Quantifies traffic-related air pollution and the associated respiratory health for vulnerable school children living in a near-road, underserved community in El Paso, Texas; develops guidelines on healthy living for the underserved, roadside communities.</p>	UTEP	Dr. Wen-Whai Li	TTI, JHU
<p><i>Development and Evaluation of Connected Vehicle Application for Alternative Fuel Trucks (#01-05)</i></p> <p>Evaluates the energy and emission benefits of battery electric trucks and plug-in hybrid electric trucks over conventional diesel trucks; develops a connected vehicle application for these trucks.</p>	UCR	Dr. Peng Hao Dr. Kanok Boriboonsomsin	GT, TTI
<p><i>Health Risk Characterization for Transportation Users (#01-06)</i></p> <p>Develops a cumulative exposure and risk profile for transportation workers and/or transportation system users considering chemical and non-chemical stressors.</p>	JHU	Dr. Mary Fox Dr. Kirsten Koehler	UTEP

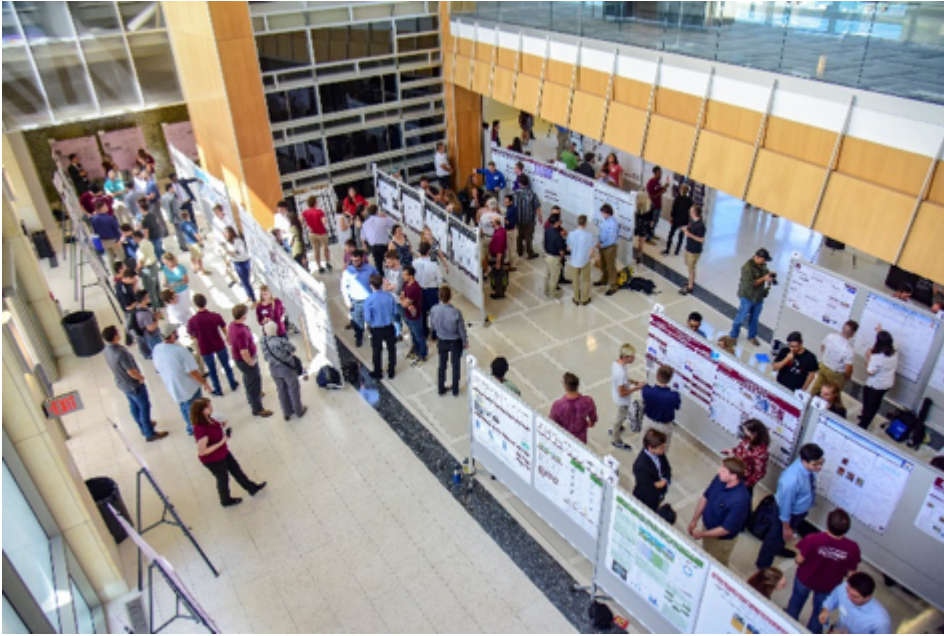
YEAR TWO Competitive Projects

CARTEEH’s Competitive Research Program was initiated in the Center’s second year. Problem statements were requested at each of the partner institutions, and out of 22 problem statements, nine projects that address

one or more of CARTEEH’s focus areas were funded by the consortium. CARTEEH now has over 30 researchers and students working on a broad range of projects, all addressing the center’s mission.

Year Two Research Projects

Project	Lead Institution	Principal Investigator	Project Number
<i>Assessing Regulatory Compliance and Community Air Pollution Impacts of Crude Oil by Rail (CBR) Transport in Baltimore City, Maryland</i> Delivers evidence-based characterization of emissions impacts of CBR within Baltimore City, Maryland.	JHU	Dr. Genee Smith	JHU-01-07
<i>PM Exposure for Paratransit Transport</i> Characterizes exposure to PM faced by sensitive populations using paratransit transport.	GT	Dr. Alex Samoylov	GT-01-08
<i>Measuring Temporal and Spatial Exposure of Urban Cyclists to Air Pollutants Using an Instrumented Bicycle</i> Develops an understanding of local cyclists’ exposure to PM2.5 air pollutants in an urban environment.	GT	Dr. Kari Watkins	GT-01-09
<i>Traffic-Related Air Pollution and Childhood Asthma in the United States: A Burden of Disease Assessment</i> Conducts a burden of disease estimate of childhood asthma attributable to traffic-related air pollution within the United States.	TTI	Dr. Haneen Khreis	TTI-01-10
<i>Characterizing In-Cab Air Quality in Heavy Duty Diesel Construction Equipment</i> Analyzes air quality and driver exposure inside the cabs of heavy-duty diesel construction equipment.	TTI	Dr. Phil Lewis	TTI-01-11
<i>Dockless Mobility: Addressing Safety, Emissions and Gaps in Policy Making</i> Examines emissions exposure on dockless mobility users in Dallas, Texas.	TTI	Dr. Suriya Vallamsundar	TTI-01-12
<i>Quantifying Bioavailable Metals and Potential Dust Emissions from Highway-Related and Desert Sediments at Lordsburg Playa, New Mexico.</i> Scopes the presence of bioavailable metals and potential dust emissions from highway-related and desert sediments in New Mexico.	UTEP	Dr. Thomas Gill	UT-01-13
<i>Secondary Particulate Matter Exceed Primary Emissions from Current Gasoline Vehicles: Air Quality and Public Health Implications</i> Assesses emissions from gasoline direct injection and multipoint injection vehicles when operated under different driving cycles.	UCR	Dr. Georgios Karavalakis	UCR-01-14
<i>Quantifying Traffic Congestion-Induced Change of Near-Road Air Pollutant Concentration</i> Quantifies the contributions to the ambient air quality degradation due to traffic congestion based on statistical methods.	UCR	Dr. Jill Luo	UCR-01-15



Interns participated in Texas A&M University's campus-wide LAUNCH: Undergraduate Research Poster Session, where they gained valuable experience in presenting and explaining their research results to a wide audience.

Education and Workforce Development

Education and workforce development are central to CARTEEH's mission. Our workforce development activities support the growth of a transportation workforce equipped to deal with emerging needs in the areas of emissions, energy, and health.

At each institution, CARTEEH students' robust academic programs are supplemented through activities such as professional development programs, internships, and practical research experience. Both graduate and undergraduate students participate in research projects with mentors and professors as an integral part of their University Transportation Center (UTC) experience.

First Annual CARTEEH Summer Internship Presents Young Transportation Professionals with Unique Learning Opportunities

The first annual CARTEEH Summer Internship program successfully concluded in early August 2018. Interns spent 10 weeks in the CARTEEH offices working on projects related to vehicle emissions, air quality, and transportation and health, as well as participating in a variety of other activities.

The focus of each internship was the development and completion of an individual project, guided by an assigned mentor. At the culmination of their projects, interns participated in Texas A&M University's campus-wide LAUNCH: Undergraduate Research Poster Session, where they gained valuable experience in presenting and explaining their research results to a wide audience.

In addition to conducting their projects, and together with interns from the SAFE-D UTC, students also participated in other transportation-related activities such as attending brown-bag luncheons presented by TTI researchers on various areas of transportation research, observing a crash test, and touring and experiencing a test drive of TTI's driving simulator.



CARTEEH intern Manny Velasco discusses his project poster with SAFE-D UTC Associate Director Sue Chrysler.



CARTEEH intern Andrew Glazener discusses his project with another LAUNCH student.



Cris Nunez and Kristen Sanchez congratulate each other on jobs well done.

CARTEEH Student of the Year

Each fall, the Council of University Transportation Centers (CUTC) recognizes an outstanding graduate student from each University Transportation Center. Students who are nominated within each center are evaluated on their accomplishments in technical merit, research capability, academic performance, and leadership. The finalist receives a \$1,000 stipend and is invited to attend the CUTC Banquet and annual Transportation Research Board meeting held in Washington, D.C.

2017 STUDENT OF THE YEAR ALANA WILSON

GT

Alana Wilson is a second year master's student working with Dr. Michael Rodgers at Georgia Tech. Alana has been a student research assistant for the past three years, working on research projects in transportation, air quality, and alternative energy. She currently works with Dr. Rodgers on a CARTEEH project that focuses on modeling population exposures related to emissions generated by port operations.



2017 Student of the Year
Alana Wilson
GT

2017 STUDENT OF THE YEAR – RUNNER-UP ADAN RANGEL

UTEP

Adan Rangel is runner-up for the 2017 Student of the Year award. Adan studied at the University of Texas at El Paso where he researched underserved communities that are at higher risk of exposure to excess levels of air pollution. As runner-up, Adan also attended the 2018 TRB Annual Meeting.



2017 Student of the Year –
Runner-Up
Adan Rangel
UTEP

CARTEEH Students

With its multidisciplinary focus, CARTEEH's health and transportation program attracts students from a variety of academic backgrounds. From public health to geosciences to engineering, the intersection of health and transportation is a diverse field, and CARTEEH has recruited an outstanding group of students. Following are just a few of our students.

INYANG UWAK

TTI

Inyang Uwak is a doctor of public health candidate in the Department of Environmental Health at Texas A&M University School of Public Health. Inyang has a medical degree from the University of Calabar, Nigeria, a master of public health degree and a certificate in occupational and environmental health from Johns Hopkins University. Inyang is working on the CARTEEH border crossing emissions impact study.



Inyang Uwak
Texas A&M Transportation
Institute TTI

MARCOS MENDEZ

UTEP

Marcos Mendez is an M.S. student in geological sciences at UTEP. He is a graduate of University of Houston, with B.S. degrees in geology and geophysics, and additional background in civil engineering and experience in the Texas petroleum industry. He is working on the CARTEEH project titled "Quantifying Land Surface Properties for Mitigating Blowing Dust Impact on Highway Safety at Lordsburg Playa, New Mexico."



Marcos Mendez
UTEP

AYLA MORETTI

UCR

Ayla Moretti is a third year Ph.D. student in the Department of Chemical and Environmental Engineering at UCR. Ayla's research specialization is air quality, particularly secondary organic aerosols aged from vehicle emissions. Ayla is currently working on the CARTEEH project titled "Quantifying Traffic Congestion-Induced Change of Near-Road Air Pollutant Concentration."



Ayla Moretti
UCR

CAVAN MCCAFFERY

UCR

Cavan McCaffery is a second year Ph.D. student in mechanical engineering. Cavan works at the College of Engineering Center for Environmental Research and Technology (CE-CERT) and is currently testing renewable biodiesel fuels and their effects on engine performance and emissions.



Cavan McCaffery
UCR

JUAN AGUILERA

UTEP

Juan Aguilera is a third year Ph.D. student in the Interdisciplinary Health Sciences program at UTEP. He graduated from Universidad Autonoma de Ciudad Juárez with a medical degree in 2009 and received a master's in public health (MPH) from UTEP in 2016. Currently, Juan is a research associate supported by CARTEEH and the Paso Del Norte Institute for Healthy Living.



Juan Aguilera
UTEP

EMMA COGAN

JHU

Emma graduated in 2018 with an MPH focusing in global environmental sustainability, epidemiology, and biostatistics. She is currently a first year Ph.D. student in the Exposure Sciences and Environmental Epidemiology track in the Department of Environmental Health and Engineering at JHU.



Emma Cogan
JHU

SOHEIL SOHRABI

TTI

Soheil Sohrabi is a Ph.D. student in Zachry Department of Civil Engineering at Texas A&M University. He holds a master's degree in transportation engineering from Amirkabir University of Technology (Tehran Polytechnic). Prior to starting his Ph.D. project, he worked on a number of transportation projects with private sector consultants. At CARTEEH, he is working on assessing the impact of the transportation systems on public health by quantifying the burden of disease from transportation-related exposures.



Soheil Sohrabi
TTI

RAED ALOTAIBI

TTI

Raed Alotaibi is a third year doctor of public health student in the Department of Epidemiology and Biostatistics at the Texas A&M School of Public Health. He has a medical degree from the Imam Abdulrahman Bin Faisal University, Saudi Arabia, and a master of public health degree from Johns Hopkins University. Raed's research focuses on the burden of disease due to traffic related air pollution. Raed is currently working on the CARTEEH project titled "Traffic Related Air Pollution and the Burden of Childhood Asthma in the Contiguous United States in 2000 and 2010."



Raed Alotaibi
TTI

APRIL GADSBY

GT

April is a third year Ph.D. student in civil engineering. Her research involves using an instrumented bike to explore the environmental causes of cyclist stress and discomfort, including the impacts of route choice and infrastructure type on particulate matter exposure.



April Gadsby
GT

Program Announced

3

REASONS TO REGISTER TODAY!

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<https://events.tti.tamu.edu/conference/2019-carteeh-symposium/>



Technology Transfer

Technology transfer is a key part of the research process, and one that must be integrated with our R&D activities and not treated as an afterthought. We place a high value on stakeholder identification and engagement, as well as emphasizing information dissemination and the creation of open-access tools and methods that enable practical application of cutting-edge research findings.

CARTEEH's technology transfer goals are to:

1. **Facilitate** the implementation of research findings by both the transportation and public health sectors.
2. **Share** the knowledge generated with the research and educational communities.
4. **Collaborate** and leverage our work through partnerships with the private and public sectors, tailoring some of the research to their needs and answering open questions.
5. **Pursue** commercialization and licensing opportunities into products that can be used by the private and public sector to collect, visualize, and analyze data quickly and efficiently.
2. **Engage** stakeholders early, in a targeted manner and throughout the R&D process.

Searchable Literature Library: Transportation Emissions, Air Pollution, Exposures, and Health

CARTEEH researchers and student interns have created a searchable literature library, which is housed on the CARTEEH website. Led by Haneen Khreis and Kristen Sanchez, the literature library is intended as a resource for students, researchers, and practitioners interested in transportation and health, especially the impact of transportation emissions and air pollution on human health. The library is open access and is accompanied by an online search tool. The library currently contains a reference list of over 800 scientific studies relevant to the full-chain of events between transportation pollution sources and health impacts. It tabulates several attributes for each study, including the citation details, the publication type, topic area, and type of study. The reference list will be periodically updated to include new studies as they become available.

Online Library Search

Search for studies based on topics, study types and selected keywords. You can also export results to a CSV file.

Topics

Select one or more topics to narrow your search. The selected terms will be combined using the "and" operator.

- Traffic
- Emissions
- Air quality/ Dispersion
- Exposure
- Health
- Technologies/ Disrupters

Study Types

Select one or more study types to narrow your search. The selected terms will be combined using the "and" operator.

- Measurement
- Modeling
- Practice/ Policy
- Review

CARTEEH Researcher Awarded 2018 ISEE Rebecca James Baker Award

Assistant Research Scientist Haneen Khreis with TTI's CARTEEH has been awarded the prestigious 2018 Rebecca James Baker Award by the International Society for Environmental Epidemiology. Khreis received this award for her work on the influence of traffic-related air pollution on childhood-onset asthma. "Not all people are equally susceptible to the adverse effects of air pollution," Khreis says. "Yet, few studies exist that look at how ethnicity might modify the risk of children developing asthma as a result of exposure to air pollution." Khreis is the first engineer-in-training to receive the award "created in memory of Dr. Rebecca Khreis Baker, a young investigator with a commitment to environmental epidemiology as a tool for improving public health and quality of life." Khreis's research assesses and quantifies the relationship between the onset of childhood asthma and the exposure to traffic-related air pollution. It also considers how ethnicity might impact the likelihood asthma will develop in children exposed to air pollution caused by traffic. "Dr. Khreis's research is groundbreaking and exactly the kind of innovative approach to studying health and the environment that our center is becoming known for," says Assistant Agency Director Joe Zietsman, who leads CARTEEH. "She's already become a thought leader in the subject matter, and the center and the industry as a whole will no doubt benefit from more of her findings in the very near future."



Haneen Khreis

"Few studies exist that look at how ethnicity might modify the risk of children developing asthma as a result of exposure to air pollution," Khreis says.

Center Leadership

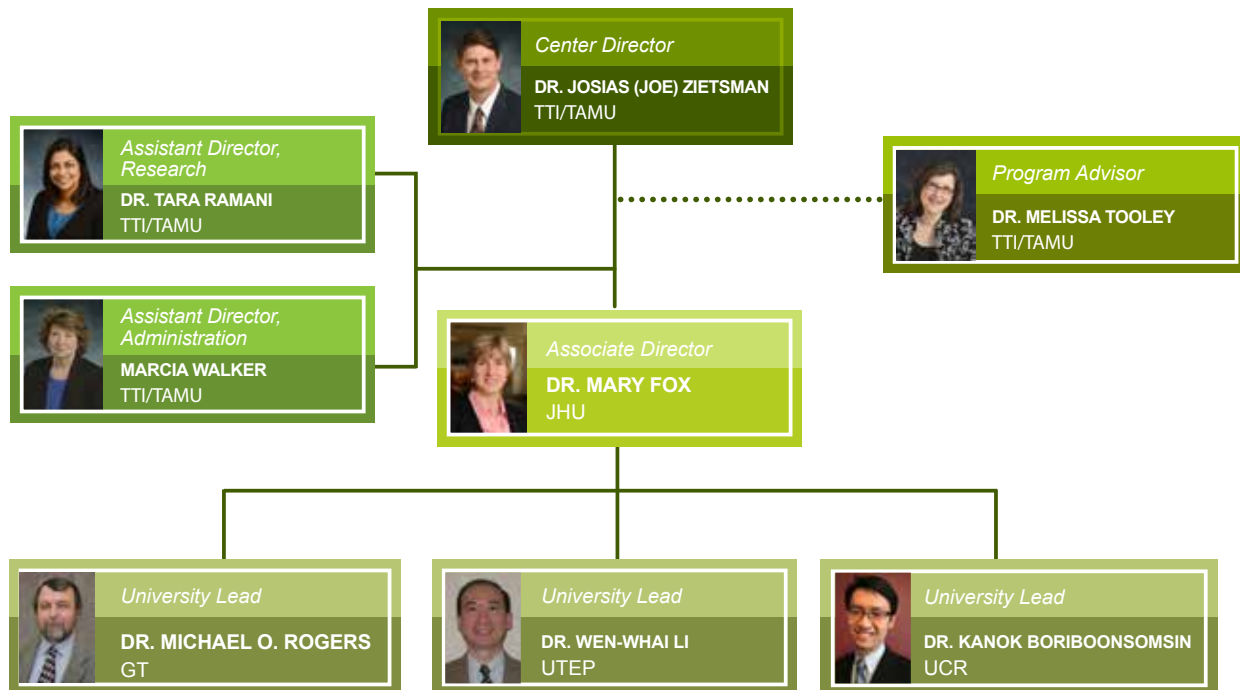
Advisory Board

CARTEEH's Advisory Board assists the center's executive committee by providing independent strategic advice on:

- Scientific activities and research programs
- Emerging transportation and health issues and trends in national and global contexts
- Knowledge translation and dissemination of research
- Partnerships and leveraging opportunities

CARTEEH

EXECUTIVE COMMITTEE



MATTHEW BARTH, PH.D.

University of California – Riverside

Matthew Barth is the Yeager Families Professor at the College of Engineering, University of California-Riverside. He is part of the intelligent systems faculty in Electrical and Computer Engineering and serves as the director for the CE-CERT, UCR's largest multidisciplinary research center.

Dr. Barth is active with the U.S. Transportation Research Board, serving in a variety of roles in several committees, including the Committee on ITS and the Committee on Transportation Air Quality. He was awarded the TRB Pyke Johnson Award for TRB outstanding paper in 2007. Dr. Barth has been active in the Institute of Electrical and Electronics Engineers (IEEE) Intelligent Transportation System Society for many years, participating in conferences as a presenter, invited session organizer, session moderator, reviewer, associate editor of the Transactions of ITS, and member of the IEEE ITSS Board of Governors. He was the IEEE ITSS Vice President for Conferences from 2011–2012, President-Elect for 2013, President for 2014–2015, and Past-President for 2016. He recently received the IEEE ITSS Outstanding Research Award.



Matthew Barth, Ph.D.
University of California –
Riverside

THOMAS A. BURKE, PH.D.

Johns Hopkins University Bloomberg School of Public Health

Thomas A. Burke, Ph.D., MPH, is the Jacob I. and Irene B. Fabrikant Professor and Chair in Health Risk and Society at Johns Hopkins University Bloomberg School of Public Health, Department of Health Policy and Management. He holds joint appointments in the Department of Environmental Health Sciences and the School of Medicine Department of Oncology. He is also Director of the Johns Hopkins Risk Sciences and Public Policy Institute.

Dr. Burke was nominated by President Barack Obama to serve as EPA Assistant Administrator for the Office of Research and Development. From January 2015 until January 2017, Dr. Burke was the EPA Science Advisor and Deputy Assistant Administrator for Research and Development. His research interests include environmental epidemiology and surveillance, evaluation of population exposures to environmental pollutants, assessment and communication of environmental risks, and application of epidemiology and health risk assessment to public policy. Before joining the University faculty, Dr. Burke was Deputy Commissioner of Health for the State of New Jersey and Director of Science and Research for the New Jersey Department of Environmental Protection.



Thomas A. Burke, Ph.D.
Johns Hopkins University
Bloomberg School of Public
Health

Center Leadership

ROBERTO OSEGUEDA, PH.D.

University of Texas at El Paso

Dr. Roberto A. Osegueda has served as the Vice President for Research at the University of Texas at El Paso since September 2005, with the primary responsibility of overseeing all research and sponsored project activities at the university. Dr. Osegueda has served the University of Texas at El Paso since September 1987 in various capacities as faculty, researcher, administrator, and full professor in September 2003. In administrative roles, he has been assistant and associate dean of engineering, acting dean of engineering, and director of the FAST Center for Structural Integrity of Aerospace Systems. His research has been funded by numerous agencies, including the Air Force Office of Scientific Research, NASA, Ballistic Missile Defense Organization (now Missile Defense Agency), the Johns Hopkins University Applied Physics Laboratory, Raytheon, NIST, Air Force Research Labs, the Texas Department of Transportation, and other agencies and industrial partners.



Roberto Osegueda, Ph.D.
University of Texas at El Paso

KATHERINE TURNBULL, PH.D.

Texas A&M Transportation Institute

Dr. Katie Turnbull is an executive associate director at TTI. She is also an executive professor in the Department of Landscape Architecture and Urban Planning at Texas A&M University. At TTI, she maintains a diverse research portfolio, leads Institute initiatives, and manages TTI's Environment and Planning Research Group. Active in the Transportation Research Board (TRB) of the National Academies of Sciences, Engineering, and Medicine, she is currently serving as the Chair of the TRB Executive Committee. Dr. Turnbull received the Regents Fellow Award from Texas A&M University System in 2015. In 2014, she was recognized with TRB's W.N. Carey, Jr. Distinguished Service Award, recognizing her long-time outstanding service to TRB and transportation research. In 2013, she received the Ethel S. Birchland Lifetime Achievement Award from the American Road and Transportation Builders Association, which honors individuals who promote leadership and career advancement for women in the transportation design and construction industries. In 2012, she was named a lifetime national associate of the National Research Council based on her many years of volunteer service with TRB.



Katherine Turnbull, Ph.D.
Texas A&M Transportation Institute



Transportation, Air Quality, and Health Symposium

February 18–20, 2019

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