



FHWA Research Associateship Program Highlights

Where Are They Now?

Exploratory Advanced Research . . . Next Generation Transportation Solutions



The opportunity to work on leading-edge transportation research in world-class facilities with top-notch experts might sound like a dream for some postdoctoral candidates pursuing a transportation-related career in business, academia, or government. For these doctoral candidates, their dream can become a reality if they become a research associate with the Federal Highway Administration (FHWA).

The Exploratory Advanced Research (EAR) Program funds postdoctoral research associates to work alongside FHWA staff on innovative research that one day could serve as the foundation for solving transportation problems on our Nation's roads and highways.

Through the NRC Research Associateship Program (RAP), FHWA is able to offer qualified individuals opportunities to work on research problems within its laboratories and offices. The National Academy of Sciences (formerly the National Research Council (NRC)) postdoctoral research associates work alongside FHWA researchers to achieve innovative research and make discoveries that could ultimately lead to safer roads, longer-lasting infrastructure, and environmentally sound and efficient transportation systems.

Prior to arriving at FHWA, research associates are matched up with an FHWA adviser who mentors them throughout the program. The associates work in a professional highway research laboratory environment to solve real-world transportation problems.

“This program has really benefited me and given me a lot of opportunities to work on the most advanced areas in the transportation field. We're given access to top-tier infrastructure and experimental devices,” said Yi Zhao, a former research associate who now works for the District of Columbia's Department of Transportation as a traffic engineer.

Postdoctoral associates accepted into the RAP find that the program offers them ample opportunities to engage in cutting-edge research and work with advanced tools—all while knowing that they have helped to solve the Nation's perplexing transportation problems.

Why should you be a research associate at FHWA?

The benefits of spending 2 or 3 years as a research associate span from the personal to the professional. Research associates work at a national research laboratory with unique facilities and equipment, where they have opportunities to conduct and publish interesting and often multidisciplinary research.

“I was able to further investigate aspects that were uncovered as part of my Ph.D. dissertation. This was possible given the access to advanced characterization tools at the sponsor's laboratory,” said former research associate Edith Arámbula-Mercado. She is now a research engineer and manager of the Recyclable Pavement Materials Program at the Texas A&M Transportation Institute (TTI). “I was also able to write several peer-reviewed journal papers. In addition, I had access to cutting-edge and innovative research ideas and proposals.”

The associates' projects span from eco-cooperative adaptive cruise control to performance-based asphalt mix design, to an



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operational and safety analysis of intersection designs and cost-benefit analyses of connected and automated vehicle operations.

By the time an associate completes his or her tenure at FHWA, that associate will have made lifelong connections, gained a national perspective of research needs, and will have had experience at a world-class institution that he or she can add to a resume.

“It’s a truly unique opportunity to focus on research goals that advance yourself as an emerging researcher,” said former research associate David Mensching. FHWA now employs him as the asphalt materials research program manager. “The prestige and network opportunities provided by FHWA make it easy to flourish and position yourself for a promising future.”

Since the program started in 1992, FHWA has hosted 50 research associates to its Turner-Fairbank Highway Research Center (TFHRC) and its Headquarters offices.

Of that, 35 individuals are former associates who have completed their tenure and 15 are current associates working with FHWA. After leaving the program, their work titles now include senior scientific researcher, associate engineer, chief of physics, professor of chemical technology, research chemist, and research and development manager.

The 15 current associates are supporting research ranging from ultra-high performance concrete to artificial intelligence-aided bridge condition assessments, vehicle platooning, and connected and automated vehicle operations.

Perhaps the best way to illustrate how RAP benefits individuals is to learn about some who have used their experience at FHWA to leverage their career and research interests.

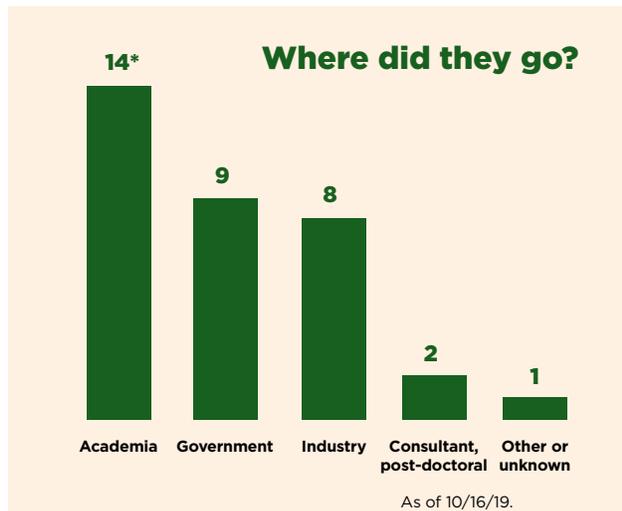


Figure 1. Life after RAP: 34 former NRC associates from 1992 to 2019. *Does not include one former renowned associate.

“I would recommend the program because it provides a great opportunity for young research scholars to focus on research and explore ideas in practical research areas, particularly in engineering,”

said Nopadon Kronprasert, a former research associate who’s now the director of the Green Infrastructure and Transport Technology Research Center at the Chiang Mai University in Thailand.

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Research Associates Alumni Profiles

Edith Arámbula-Mercado, Ph.D.



**Research Associate
from May 2007 - May
2008**

**FHWA Research
Adviser:**

Ernest “Ernie” J. Bastian,
Jr. (retired), Office of
Infrastructure Research
and Development

Research at FHWA:

The influence of
microstructure
properties on the

performance of pavement construction materials

First job after RAP: Senior engineer with Applied
Research Associates

Current position: Research engineer and manager of the
Recyclable Pavement Materials Program at TTI

As a research associate, Arámbula-Mercado delved into a number of research projects that dealt with pavements. Project topics included a comparison of dynamic modulus versus relaxation modulus tests; the use of fracture equations to evaluate the crack growth of mixtures subjected to the push-pull test in comparison to field performance; a determination of the effective diffusion coefficient of asphalt mixtures using numerical algorithms and comparison to experimental data; experimental measurements of moisture diffusion coefficients using a simple laboratory test setup; the effect of compaction on moisture diffusion; and the development of an artificial neural network tool to identify coarse aggregates in digital images with noise and poor contrast. The research Arámbula-Mercado performed while a research associate helped build a better understanding of the distress mechanisms of asphalt pavement that support enhanced pavement performance models.

At TTI, she built upon the research and skills that she developed at FHWA. Her work has included studying the moisture susceptibility of asphalt mixtures with warm mix additives; conducting laboratory and field aging of asphalt mixtures; testing the design and performance of asphalt mixtures with foamed asphalt binders; and studying the effects of recycling agents on asphalt mixtures with reclaimed asphalt pavement and other recycled materials.

Arámbula-Mercado is a civil engineer by training. In Mexico, where she completed her undergraduate studies, the bachelor’s degree in civil engineering had only one specialty: structures. Although she enjoyed the topic, she always gravitated toward other areas within the civil engineering discipline.

After graduation, she worked for the City of San Pedro Public Works Department in Mexico, where she was asked to develop a pavement management system for the City in a short time-frame of 10 months. Although she had limited knowledge of that topic, she was sent to a couple of training classes in the United States where she was able to soak in the information and deliver an inventory of streets and highways, a catalog of pavement distresses and severities, and a proposed maintenance plan for the City. The experience opened her eyes to the world of transportation, in general, and pavement materials, in particular. More importantly, it spurred her interest in pursuing a master’s and doctorate degree in the United States, where she learned about pavement management, asphalt mixture design and performance, and pavement treatments.

“I’ve recommended this program to Ph.D. students that I have worked with during my tenure at TTI,” Arámbula-Mercado said. “I feel the program is a great opportunity to dig deeper into scientific issues with accessibility to laboratory resources and advanced characterization tools. Being a research associate is prestigious and helps enhance future professional opportunities.”

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Research Associates Alumni Profiles

Examples of published papers:

- Kaseer, F., Bajaj, A., Epps Martin, A., **Arámbula-Mercado, E.**, and Hajj, E. (2019). "Strategies for Producing Asphalt Mixtures with High RAP Content, Case Study." *ASCE Journal of Materials in Civil Engineering*, Vol. 31, No. 11, DOI: 10.1061/(ASCE)MT.1943-5533.0002910.
- Kaseer, F., **Arámbula-Mercado, E.**, and Epps Martin, A. (2019). "A Method to Quantify Reclaimed Asphalt Pavement Binder Availability (Effective RAP Binder) in Recycled Asphalt Mixes." *Transportation Research Record: Journal of the Transportation Research Board*, Vol. 2673, Issue 1, pp. 205-216.
- Kaseer, G., Garcia Cucalon, L., **Arámbula-Mercado, E.**, Epps Martin, A., and Epps, J. (2018). "Practical Tools for Optimizing Recycled Materials Content and Recycling Agent Dosage for Improved Short- and Long- Term Performance of Rejuvenated Binder Blends and Mixtures." *Journal of the Association of Asphalt Paving Technologists*, Vol. 87, pp. 513-555.

- **Arámbula-Mercado, E.**, Chavarro-Muñoz, S.J., Hu, S., Epps, J., Park, E.S., and Epps Martin, A. (2018). "High Reclaimed Asphalt Pavement (RAP) Asphalt Mixes for Low Volume Roads." *FDOT BE194*, Texas A&M Transportation Institute, College Station, TX.

Awards/Honors/Positions:

- Transportation Research Board (TRB) Committee on Surface Requirements of Asphalt Mixtures, Member, 2017 - Present
- TRB Standing Committee on Mineral Aggregates, Member, 2016 - Present

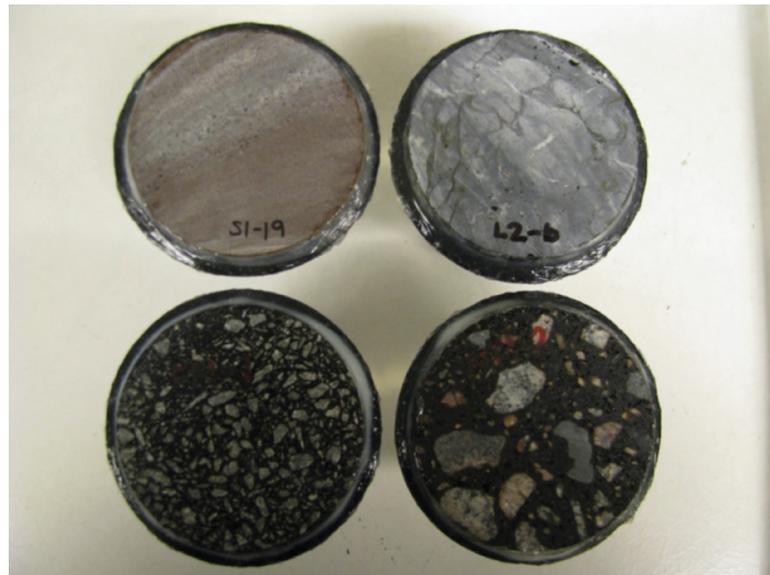


Figure 2. Former associate Edith Arámbula-Mercado supported FHWA research that studied the influence of microstructure properties on the performance of pavement construction materials. © Edith Arámbula-Mercado

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Research Associates Alumni Profiles

Nopadon Kronprasert, Ph.D.



**Research Associate
from October 2012 -
May 2014**

**FHWA Research
Adviser:** Wei Zhang,
Office of Safety
Research and
Development

Research at FHWA:
Operational and safety
analysis of alternative
intersections/
interchange designs

First job after RAP: Lecturer with the Department of Civil Engineering, Chiang Mai University, Chiang Mai, Thailand

Current position: Director of Green Infrastructure and Transport Technology Research Center and professor with the Department of Civil Engineering at Chiang Mai University

As an associate at FHWA, Kronprasert participated in research that involved developing operational and safety analyses of alternative intersection and interchange designs. The research looked at whether a microscopic traffic simulation model could effectively evaluate the operational and safety performances of alternative designs.

His current research at Chiang Mai University focuses on highway operations and safety. For highway safety, he is working on road safety audit programs with government agencies, and he is conducting in-depth accident investigations involving motorcycles and buses. He is also developing accident prediction models and a road assessment program. For highway operations, he is working on developing applications of microscopic traffic simulation models to evaluate the operational and safety performance of transport infrastructure facilities, including analyzing designs for intersections and interchanges.

Also at Chiang Mai University, Kronprasert established a laboratory and research center, recruited students to join the university's graduate programs in transportation engineering, and created job opportunities for scholars.

He developed a simulation platform at the university's research center, and he set up the research direction at the university similar to what he learned as a research associate with FHWA.

Examples of published papers:

- Hunsanon, T., **Kronprasert, N.**, Upayokin, A., and Songchitruksa, P. (2017). "Control Strategy for Vehicular and Pedestrian Midblock Crossing Movements." *Transportation Research Procedia*, Vol.25C, pp. 1680-1697.
- Sreetaraso, N. and **Kronprasert, N.** (2016). "Measuring Efficiency of Traffic Management During Special Events by using Restricted Crossing U-Turn Intersection." Presented at the National Conference of Civil Engineering, June 29-30, 2016, Songkhla, Thailand.
- Krause, C. **Kronprasert, N.**, Bared, J., and Zhang, W. (2015). "Operational Advantages of Dynamic Reversible Left-Turn Control at Existing Signalized Diamond Interchanges." *Journal of Transportation Engineering*, Vol. 141, No. 5.
- Zhang, W. and **Kronprasert, N.** (2014). "Crash Prediction Models for Rural Restricted Crossing U-Turn Intersections." *Public Roads*, September/October Issue, 2014.
- Lochrane, T.W., **Kronprasert, N.**, Bared, J., Zhang, W., and Dailey, D. (2014). "Determination of Mini-Roundabout Capacity in the United States." *Journal of Transportation Engineering*, Vol. 140, No. 10.

Awards:

- Planung Transport Verkehr (PTV) User Group Best Presentation, Singapore, 2017
- Asian Transportation Research Society Young Researcher Best Paper, 2017

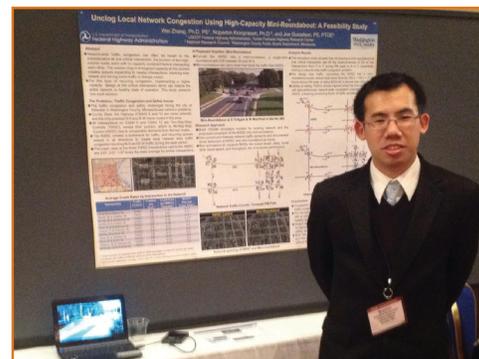


Figure 3. Former associate Nopadon Kronprasert stands beside a poster detailing research findings.
© Nopadon Kronprasert

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Research Associates Alumni Profiles

David Mensching, Ph.D.



**Research Associate
from May 2015 -
August 2016
FHWA Research**

Adviser: Nelson Gibson (former FHWA employee), Office of Infrastructure Research and Development

Research at FHWA: Performance-based mixture design, rheological parameters

for asphalt mixture and binder characterization

First job after RAP: Asphalt pavement engineer at FHWA

Current role: Asphalt materials research program manager at FHWA

As a research associate, Mensching worked on performance-based mixture design research for intermediate- and low-temperature cracking. This fit in with FHWA's performance-related specification research and involves using fundamental tests to better design asphalt pavements. Mensching also continued his work assessing rheological parameters that was done during his Ph.D. study.

Although Mensching has finished the program, he's still at FHWA—but as a manager of the Asphalt Materials Research Program. The program has a broad portfolio of original research covering topic areas such as reclaimed asphalt pavement, performance specifications, long-life wearing courses, asphalt binder specifications, artificial intelligence, connected pavements, and resilience. Mensching's time at FHWA has come full circle, and he now serves as an adviser to current research associates.

"I was able to build many connections that would've been difficult without FHWA. I learned from premier researchers in my field and was advised by one of the brightest asphalt researchers in the world. I learned not only how to build connections and better initiate research, but it was my first exposure to managing my own efforts and programming research with other staff and partners," Mensching said. "I also published

extensively in my time as an associate, which built national expertise. It afforded me familiarity with my would-be colleagues at FHWA."

Examples of published papers:

- Christensen, D., **Mensching, D.J.**, Rowe, G., Anderson, R.M., Hanz, A., Reinke, G., and Anderson, D. (2019). "Past, Present, and Future of Asphalt Rheological Parameters." Transportation Research Circular E-C241, Transportation Research Board of the National Academies, Washington, DC.
- Oshone, M., Sias, J.E., McCarthy, L.M., **Mensching, D.J.**, and Dave, E.V. (2019). "Developing a Performance-Based Specification Framework for Asphalt Pavements." Accepted for publication and presentation, *Journal of Association of Asphalt Paving Technologists*, Association of Asphalt Paving Technologists' Annual Meeting, Fort Worth, TX.
- Oshone, M., **Mensching, D.J.**, Daniel, J.S., and McCarthy, L.M. (2018). "Comparative Evaluation of Mechanistic-Empirical Performance Models as a Tool for Establishing Pavement Performance Specifications." *Journal of Road Materials and Pavement Design*, DOI: 10.1080/14680629.2018.1424647.
- Office of Preconstruction, Construction, and Pavements. (2018). "Mobile Asphalt Testing Trailer Findings: Asphalt Mixture Performance Tester," Publication FHWA-HIF-19-009, Federal Highway Administration.
- **Mensching D.J.**, Daniel, J.S., and Underwood B.S. (2017). "Developing an Indicator for Fatigue Cracking in Hot Mix Asphalt Pavements Using Viscoelastic Continuum Damage Principles." *Journal of Road Materials and Pavement Design*.

Awards/Honors/Positions Held:

- 2019 - Achievement of the Month Award, Office of Infrastructure Research and Development, Federal Highway Administration
- 2018 - Achievement of the Month Award, Office of Infrastructure Research and Development, Federal Highway Administration
- 2017 - Runner-Up, Walter J. Emmons Award, Association of Asphalt Paving Technologists
- Editor, *Journal of the Association of Asphalt Paving Technologists*

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Research Associates Alumni Profiles

Yi Zhao, Ph.D.



**Research Associate
from December 2015 -
June 2018**

**FHWA Research
Adviser:** Joe Bared
(retired), Office of
Operations Research
and Development, and
Peter Huang, Office of
Operations Research
and Development

Research at FHWA:
Driver vehicle interface

analysis, microscopic transportation systems and new types of alternative intersection design, artificial intelligence applications in transportation systems

First job after RAP: Traffic engineer with the District of Columbia's Department of Transportation (DDOT)

Current role: Traffic engineer with DDOT

At FHWA, Zhao was involved in five projects: the creation of an artificial intelligence-based traffic signal analysis and control decision support system, also known as short-term traffic flow forecasting, which the Delaware Department of Transportation eventually adopted; a study that assessed using machine learning technology for traffic incident detection; a project that sought to determine the operational benefit of the connected automated vehicles for freeway traffic; a feasibility study looking at the contraflow left-turn pocket lane design; and an evaluation of the alternative design and signal control strategies for the Georgia Department of Transportation's first in-house designed diverging diamond interchange.

Following his tenure at FHWA, Zhao became a transportation engineer for DDOT where he still works today. He handles the day-to-day traffic design, construction, and operational issues occurring in Washington, DC, as a member of the traffic engineering and signal division. He provides key supports for the agency's transportation improvement plan review, its work zone traffic management plan review, its transportation system analysis and assessment, and the

daily operation of the District of Columbia's Transit Signal Priority program.

"The Office of Operations Research & Development provided me with access to the top-level national research resources. Meanwhile, I was able to have opportunities to work with a group of the most talented people who also became my great mentors and best friends," Zhao said.

Examples of published papers:

- **Zhao Y.**, James, R., Xiao L., and Bared, J. (2018). "A Capacity Estimation Model for a Contraflow Left-Turn Lane at Signalized Intersections." Transportation Research Record. (This won the Best Paper Award from the TRB Operational Effects of Geometrics standing committee.)
- Wolfgram, J., Huang, P., **Zhao, Y.**, and Christofa, E. (2018). "A Quick and Reliable Traffic Incident Detection Methodology Using Connected Vehicle Data." Presented at the 2018 Annual Meeting of the Transportation Research Board, Washington, DC.
- **Zhao Y.**, Huang, P., Xiao, L., Ma, J., Hu, J., and Wang, Y. (2016). "A Scalable Short-Term Origin-Destination Estimation Approach Based on Modularized Network with Connected Vehicle Technology." Presented at the 2017 Annual Meeting of the Transportation Research Board, Washington, DC.
- Xiao, L., Wang, Y., Hu, J., and **Zhao, Y.** (2016). "Responsive Signal Control with Active Connected Vehicles." Presented at the 2017 Annual Meeting of the Transportation Research Board, Washington, DC.

"This program has really benefited me and given me a lot of opportunities to work on the most advanced areas in the transportation field. We're given access to top-tier infrastructure and experimental devices,"
said Yi Zhao.

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Where Are They Now?

How to get involved

FHWA is actively seeking qualified postdoctoral candidates who want the experience of working on exciting, cutting-edge research with top-notch facilities and equipment.

Be sure to check out this webpage on how research associates support the EAR Program at FHWA: <https://highways.dot.gov/research-programs/exploratory-advanced-research/nrc-postdoctoral-fellows-help-ear-program-solve>. Once there, click on the “apply” link to view the listing of RAP opportunities available at FHWA.

To learn more about the kinds of research opportunities that research associates might support, visit: <https://www.fhwa.dot.gov/publications/research/ear/18061/index.cfm>

Photo Credits

Page 1: A simulation of an intersection that was part of the research that former associate Nopadon Kronprasert worked on while at FHWA. © Nopadon Kronprasert

Page 3: © Edith Arámbula-Mercado

Page 5: © Nopadon Kronprasert

Page 6: Source: FHWA

Page 7: © Yi Zhao

EXPLORATORY ADVANCED RESEARCH



What Is the Exploratory Advanced Research Program?

The EAR Program addresses the need for longer term, higher risk research with the potential for transformative improvements to transportation systems. The EAR Program seeks to leverage advances in science and engineering that could lead to breakthroughs for critical, current, and emerging issues in highway transportation by experts from different disciplines who have the talent and interest in researching solutions and might not do so without EAR Program funding.

To learn more about the EAR Program, visit <https://highways.dot.gov/research/exploratory-advanced-research>. The website features information on research solicitations, updates on ongoing research, links to published materials, summaries of past EAR Program events, and details on upcoming events.