

## PERSONAL NARRATIVE

### BAABAK ASHURI

Associate Professor, School of Building Construction | School of Civil & Environmental Engineering

#### OVERVIEW

Dr. Ashuri's research and teaching occupy a distinctive position in the Georgia Tech landscape, bridging the fields of building construction, civil and environmental engineering, economics, and operations research. His work has focused on **Quantitative Methods for Construction Engineering and Management** with important contributions in the areas of construction analytics, investment evaluation methods, risk analysis, innovative project delivery, and valuation of green-energy investments. Dr. Ashuri has 159 publications in these fields, including 44 refereed journal articles, 74 peer-reviewed conference papers, 38 research reports and guidebooks, 1 co-edited book, and 2 referred book chapters. Dr. Ashuri secured a funding amount of over \$6.77M (\$3.05M as principal investigator (PI) and \$3.72M as co-PI) from the National Science Foundation (NSF), Federal Highway Administration (FHWA), Department of Energy (DOE), Construction Industry Institute (CII), Georgia Department of Transportation (Georgia DOT), Royal Institution of Chartered Surveyors (RICS), ELECTRI International, Perkins+Will, and Turner Construction, to name a few. Dr. Ashuri has successfully advised and mentored 10 Ph.D. students (6 as primary advisor and 4 as co-advisor), 12 M.S. students, 17 undergraduate researchers, and 6 postdoctoral researchers.

The impact of Dr. Ashuri's work, and the esteem for which he is held by his peers, are reflected by the several awards and honors he has received, predominantly from the core professional organizations in his field. These include the *Construction Industry Institute (CII)* (Outstanding Early Career Researcher), the *American Society of Civil Engineers (ASCE)* (Thomas Fitch Rowland paper award), the *Associated Schools of Construction (ASC)* (National Research Faculty Award), the *Design-Build Institute of America (DBIA)* (Distinguished Leadership – Faculty), and the *American Association of State Highway and Transportation Officials (AASHTO)* (High Value Research "Sweet Sixteen"). Dr. Ashuri has given keynotes and invited lectures in England, China, Chile, Croatia, Bolivia, and Scotland, as well as numerous places in the U.S. His international visibility is both a consequence of his existing stature in the field, and a major contributor to continued and growing respect for Georgia Tech's eminence in this area.

Dr. Ashuri's service record to his profession has been prolific. He has chaired the *ASCE Construction Research Council (CRC)* and currently serves on the *ASCE Construction Institute (CI) Board of Governors*. His record shows past service to ASCE and DBIA with a continuous stream of appointments with increasing importance. Dr. Ashuri is also a member of key technical committees in FHWA and Transportation Research Board (TRB). He recently co-chaired the 2019 *ASCE Construction Institute (CI) Summit*.

Dr. Ashuri's innovation extends to the classroom where he has pioneered multiple class topics and courses to support new degree programs and attract interdisciplinary participation. He has mentored students from K–12 up to post-doctoral to encourage and enable students' interest and work in construction-related fields of research. While his own research is influencing the world today, his outreach efforts to students promise that his work will continue to impact that world far into the future.

#### RESEARCH, SCHOLARSHIP, AND CREATIVE ACTIVITIES

Dr. Ashuri's research has advanced theoretical foundations and applications in quantitative methods in construction engineering and management, allowing other researchers to use his findings for enhancing the performance of construction operations on several subdomains directly related to pre-construction decisions, e.g., material and labor cost forecasting, alternative project delivery selection, and green technology investments. His expertise in industrial and systems engineering and operations research, combined with his background and training in civil engineering and construction management, provide him a unique set of qualifications that has helped him rethink the grand challenges of construction engineering and management, particularly, cost overrun, infrastructure financing gap, and high energy consumption.

Ten years ago, Dr. Ashuri established the Economics of the Sustainable Built Environment (ESBE) Lab to focus his research on advancing theories, methods, and industry practices in the following research thrusts:

##### **1) Construction Economics – *Creating novel econometric models for understanding and quantifying the drivers of construction cost and forecasting its future trends***

Dr. Ashuri contributed to the state of knowledge in predictive cost analytics through:

- a. identifying the leading indicators (i.e., drivers) of construction cost that were not fully developed with current tools (i.e., macroeconomic indicators and variables representing energy market conditions); and
- b. creating predictive multivariate time series, spatial, and machine learning models that explain the variability in construction cost over time and across geographical regions.

Dr. Ashuri utilized the quantified temporal and spatial relationships to develop novel econometric models to predict construction cost. This new class of parametric cost estimation models helps owners of major capital projects improve mid-term, intermediate, and long-range cost forecasting.

The identified leading indicators of construction cost also have been used to create predictive models for several prominent construction cost indexes, such as the Engineering News-Record's (ENR's) Construction Cost Index (CCI) and the Federal Highway Administration's (FHWA's) National Highway Construction Cost Index (NHCCI). Dr. Ashuri's novel methods for index-based cost analysis and forecasting have improved the current industry practices (recognized by the FHWA as a "superior technique to explore and monitor the underlying factors that drive or influence the changes in highway construction costs"). Several national and international scholars have used Dr. Ashuri's new methods to determine the unique drivers of various construction cost indexes in their own territories. Dr. Ashuri's research in construction economics has significant policy implications, as well. For instance, Dr. Ashuri and his team examined the effect of price adjustment clauses (PACs) offered by state departments of transportation (state DOTs) on the variability of highway contractors' submitted unit price bids for major asphalt line items. PACs are one of the most widely used risk-sharing strategies by which transportation agencies shift the risk of material prices from contractors to owners. The team conducted rigorous statistical analysis on a large dataset of actual unit price bids and found no evidence supporting the statement that offering a PAC would reduce the submitted unit price bids. This is a ground-breaking finding that is contrary to the common perception from several qualitative studies that offering PACs prevents price speculation and inflated bid prices. This game-changing conclusion has brought Dr. Ashuri's team the *2017 ASCE Thomas Fitch Rowland Award* for the paper entitled, "Price Adjustment Clauses and Submitted Bid Prices for Major Asphalt Line Items in Highway Projects," published in the *ASCE Journal of Construction Engineering and Management*.

Dr. Ashuri's line of research in construction economics has been supported through 4 research grants totaling approximately \$1M in funding from public and private owners of major capital projects, such as the CII, the FHWA, state DOTs, and the Royal Institution of Chartered Surveyors (RICS) in the United Kingdom.

## **2) Project Finance & Innovative Project Delivery – *Advancing investment evaluation methods for civil infrastructure systems and streamlining project delivery through risk analysis***

Dr. Ashuri's research has made significant scholarly contributions to the academic domain of infrastructure project finance through the creation of a new class of real options models to evaluate investments in public-private partnership (P3) projects. His novel approach has addressed the core issue of P3 investment risk evaluation through treating the risk of demand shortfall internally and developing a new method for estimating the volatility of investments in P3 projects. The major benefits of the new evaluation techniques are:

- a. quantifying the correct market value of the P3 project; and
- b. avoiding inefficient risk-sharing mechanisms between public and private sectors.

Dr. Ashuri set up a theoretical foundation that influences other researchers to use his advanced evaluation methodology in developing and pricing various scalable and adaptable development strategies in several P3 domains, such as social, healthcare, and transportation markets. The superior investment evaluation models help the private sector make more informed decisions about entry into the P3 market, considering the level of support provided by the government. The government also can use the proposed model to develop flexible risk allocation mechanisms to encourage private investments without compromising its own future budgetary strength. The impacts have been substantial cost savings for taxpayers through optimizing project delivery and utilizing market competition. For example, Georgia DOT has saved \$150M in the Northwest Corridor (NWC) project and more than \$370M in the Transform 285/400 Interchange Improvement project in Metropolitan Atlanta (based on final Georgia DOT construction estimates).

Dr. Ashuri's research in innovative project delivery, alternative project financing, and risk analysis is a crossover to the industry with major practical applications. Dr. Ashuri has continued to work extensively with the TRB, DBIA, and several state DOTs to elevate the state of the practice in high-performance contracting. He developed a risk-based tool to conduct systematic assessment of candidate design-build projects. That software has been adopted by Georgia DOT and HNTB Corporation, and it has been disseminated widely in the design-build transportation industry. The impact of Dr. Ashuri's research was recognized by the *2013 High Value Research "Sweet Sixteen" Award* from the AASHTO. This competitive national award was given to Dr. Ashuri's research project since "project implementation has led to significant changes in agencies, positively impacting the conduct of business".

Dr. Ashuri received the DBIA's *2015 Distinguished Leadership Award* for his "extensive works with state departments of transportation to enhance their awareness and use of design–build, design–build–finance, and public–private partnerships." Effective July 1, 2012, Georgia legislators approved an increase in the level of using design–build for transportation projects by raising the cap to 50% (in dollars) of the total amount of construction projects awarded in the previous fiscal year. Additionally, effective July 1, 2013, Georgia legislators revised the design–build code to allow for Best Value design–build contracting. These changes were made possible, in part, by solid design–build project suitability assessments that Dr. Ashuri's research enhanced for future use.

Dr. Ashuri's line of research in this field has been supported by 15 research grants worth almost \$2.5M from public and private owners of major capital projects, such as FHWA, state DOTs, and engineering consulting firms.

### **3) Economic Decision Analysis – *Advancing valuation of green technology investments under uncertainties***

Dr. Ashuri's work contributes to the construction engineering and management global community through presentation of a new class of investment assessment tools that assist with making difficult energy investment decisions, thereby increasing the likelihood of achieving ambitious energy-saving goals and enlarging the adoption of renewable energy systems. Investment decisions in energy upgrade projects are made under uncertain circumstances: technical solutions are marketed without sufficient proof that they work over time, future energy prices are uncertain, and improvement costs are highly dependent on future market developments. Yet, designers cannot always delay their actions intended to improve the sustainability of the built environment, and this could become a recipe for unwarranted investments. Given the increasing scale of investments in green technology, Dr. Ashuri's work is crucial to offering proper investment decision-making methods to mitigate the imminent risk that funds are misappropriated and energy reduction goals are not realized.

Dr. Ashuri created a theoretical foundation for staged energy investment decision analysis that can significantly enhance the value of green projects over their life cycles and foster the adoption of sustainable solutions for society. The new class of economic decision analysis models has inspired several researchers to implement the real options theory in evaluating a wide range of sustainable construction technologies under evolving uncertainties about performance, energy price, and environmental regulations, for instance, quantifying the investor's risk profile in energy performance contracting (EPC).

Dr. Ashuri's line of research in valuation of green-energy investments has been supported by 2 NSF grants—one as a PI and one as a co-PI—with a total worth of \$2.75M, and one project sponsored by the RICS in the United Kingdom. His scholarly accomplishment in this field has been recognized by the *2018 Celebration of Engineering & Technology Innovation (CETI) Award* from CII and FIATECH, and the *2017 National Research Faculty Award* from the Associated Schools of Construction (ASC) for "advancing construction education and research in the area of decision-making and data analytics for sustainable buildings".

### **DEVELOPMENT OF TEACHING MATERIALS, MENTORING, AND PEDAGOGICAL ACTIVITIES**

Dr. Ashuri has successfully brought present-day challenges in construction to the classroom. He has done this by developing several new modules designed to provide interactive exercises focused on quantitative methods for decision-making and systems modeling. Dr. Ashuri brings these modules to life by drawing upon data from his research projects allowing students to analyze on-going, high profile construction projects. Dr. Ashuri has striven to blend research and teaching for the betterment of his students. He has been successful in creating productive opportunities for students to build upon what they learn in the classroom and apply these lessons to research questions. This has resulted in jointly authored publications and conference papers with students. Dr. Ashuri's accomplishments in teaching both inside and outside of the classroom are summarized as follows:

#### **1) Teaching Accomplishments**

Dr. Ashuri's research and educational activities are integrated. He has enhanced undergraduate and graduate curricula of construction engineering and management through the development of several educational modules focused on quantitative methods for decision-making and systems modeling. He has developed new courses and modules at Ph.D., M.S., and B.S. levels, introducing economic decision analysis, project finance, innovative project delivery systems and alternative contracting, quantitative risk assessment, real options analysis, data analytics, and systems engineering into the curricula. The next generation of construction engineers and managers has been introduced to fundamental principles of quantitative methods, risk-based decision-making, and investment evaluation in his courses. He has engaged students in team-based assignments throughout the semester to work

on open-ended, real-world problems using data from industry professionals who partner in delivering each class. For instance, students work in groups to rigorously identify and characterize uncertainty about the cost and the schedule of several megaprojects, such as the Mercedes-Benz Stadium and Georgia DOT's Northwest Corridor.

Dr. Ashuri developed a new undergraduate course, Construction Management & Megaprojects, as one of the main courses for the Global Engineering Leadership Minor (GELM) at Georgia Tech (additional support was provided through a Public Service Pathway Award from the Center for Serve-Learn-Sustain (SLS)). Dr. Ashuri has developed and taught one of the core research methods courses required for all thesis option M.S. and Ph.D. students in Building Construction. He also taught a new undergraduate/graduate course, Productivity Analysis for Solar Contractors, which was facilitated through a grant from the DOE's SunShot Initiative. He developed Advanced Construction Cost and Financial Management, a course that introduces students to the real options methodology for investment evaluation and integrated life cycle cost-benefit analysis. Course materials have been shared and adopted by Columbia University, Auburn University, and several institutions outside the United States. In 2012, Dr. Ashuri worked with Dr. Susan Tighe, Professor and Canada Research Chair in Sustainable Pavement and Infrastructure Management at the University of Waterloo, to develop two course modules, Asset Valuation and Public-Private Partnerships, for the Interuniversity Ph.D. Asset Management Boot Camp on Infrastructure Management. Recently, Dr. Ashuri has worked with Dr. Castro to develop a new online course, Economic Analysis, Risk Management, Risk Financing, and Insurance for Safety Professionals, for the newly established Professional Master's in Occupational Safety and Health (PMOSH) at Georgia Tech. This new online course is expected to significantly increase the impact of Dr. Ashuri's teaching, service, and research dissemination.

Dr. Ashuri's classes have attracted students from across the Georgia Tech campus: Architecture, Building Construction, Construction & Infrastructure Systems Engineering, Civil & Environmental Engineering, Industrial & Systems Engineering, City & Regional Planning, Public Policy, and Business. Dr. Ashuri has been ranked as an effective teacher (median score of 4.8/5.0 over the past 5 years) based on the Course Instructor Opinion Survey (CIOS). The fact that he achieved this performance at the graduate and undergraduate levels and for courses in two colleges (Design and Engineering) are further testimony to his versatility and quality as an instructor.

## **2) Student Advising and Mentoring**

Dr. Ashuri believes helping students publish the work they carry out in his classes is important. He has worked closely with several students to publish their research findings as conference or journal articles. He is committed to promoting undergraduate research to motivate students to consider graduate school and an academic position as a future career path. He has engaged 17 undergraduate students – particularly women and those from underrepresented groups – in his research projects. Five of his undergraduate researchers have been recipients of the *President's Undergraduate Research Award (PURA)*. Dr. Ashuri also has served as the faculty adviser for the Student Construction Association (SCA) at Georgia Tech.

Beyond Georgia Tech, Dr. Ashuri has been an educator of professional engineers, architects, and construction project managers. He is a certified instructor of the DBIA and currently serves on the Education Subcommittee of the DBIA Transportation Markets Committee. He served on the *Education Board of the Association for the Advancement of Cost Engineering (AACE) International*. He has conducted several training workshops for Georgia DOT engineers and project managers to elevate the state of the practice in innovative project delivery and quantitative risk analysis.

Dr. Ashuri successfully advised and mentored 10 Ph.D. students (6 as primary advisor and 4 as co-advisor), 12 M.S. students, 17 undergraduate researchers, and 6 postdoctoral researchers. He has striven to provide a supportive climate for his mentees to empower them with the technical, managerial, and entrepreneurial skills required to achieve their greatest potentials. It is gratifying that two of his Ph.D. students and four of his post-docs hold faculty positions in several institutions around the world; these positions include an Assistant Professor in the Department of Civil Engineering at the University of Texas at Arlington, an Assistant Professor in the School of Civil and Environmental Engineering at Nanyang Technological University (NTU), a Professor and Assistant to the Dean of the School of Construction Management and Real Estate at Chongqing University, an Assistant Professor in the Department of Civil Engineering at Sharif University of Technology, an Associate Professor in the School of Civil Engineering at the University of Tehran, and an Associate Professor in the School of Construction Engineering at Kyungil University. Dr. Ashuri's M.S. advisees also hold notable industry positions, such as Chief Operating Officer - I-77 Mobility Partners - Cintra US, Charlotte, NC; Associate Director | Data and Technical Services at Vermont Energy Investment Corporation, Burlington, VT; and Transportation Engineer/Planner, WSP USA, Atlanta, GA.

## **SERVICE**

Outside Georgia Tech, Dr. Ashuri has gained national and international recognition as evidenced by his leadership roles as *Co-Chair* of the 2019 ASCE CI Summit; *Assistant Specialty Editor of Quantitative Methods* for the ASCE Journal of Construction Engineering & Management; *Technical Committee Co-Chair* of the 2014 Construction Research Congress; *Member of the 2012 ASCE Industry Leaders Council (ILC)* for developing an Infrastructure Business and Financial Model Toolkit; *Member of the Educational Board*, The Advancement of Cost Engineering (AACE) International (2014–2016); and *Member* of the DBIA’s Transportation Markets and Public-Private Partnership (P3) Committees, to name a few. He served as the Vice-Chair of the ASCE *Transportation & Development Institute (T&DI) Committee on Sustainability and Environment*. He is currently serving on the ASCE *Construction Institute (CI) Board of Governors*. The CI is the leader for promoting quality in construction and its mission is to “advance the construction industry through collaboration, promotion, and raising public awareness”.

At Georgia Tech, Dr. Ashuri has been active in several service positions. At the institute level, he has served on the *Institute Graduate Curriculum Committee* (2013–2016); the *Georgia Intern-Fellowships for Teachers (GIFT) Advisory Board* for the *Center for Education Integrating Science, Mathematics and Computing (CEISMC)* (2018–present); the *Brook Byers Institute for Sustainable Systems (BBISS) Faculty Advisory Board* (2015–present); and a member of the Advisory Search Committee for the *Dean of College of Design* (2012–2013). At the College level, since September 2018, he has served as *Chair of Reappointment, Promotion, and Tenure Committee (RP&T) Committee* for the College of Design. He also served on the College of Design *Curriculum Committee* (2013–2017); *Research Council* (2011–2016); and *Advisory Committee* (2010–2013). He also served on the Advisory Search Committee for the *Chair of School of Architecture*. At the school level, in Academic Year 2012-2013, He was the *PhD Program Coordinator* of the School of Building Construction. He served on the *faculty search committees* for both School of Civil & Environmental Engineering and School of Building Construction. Since 2015, Dr. Ashuri has served on Faculty Advisory Board for *Global Engineering Leadership Minor (GELM)*.

Dr. Ashuri has a long record of establishing outreach activities to engage K–12 students, especially from minority and underrepresented groups. He hosted 30 high school students and 3 science teachers from high-needs Title I schools for 4-week summer research boot camps in sustainability and green infrastructure. Boot camps have provided a great vehicle to encourage minority students and students from rural areas in Georgia to continue their education in the science, technology, engineering, and math (STEM) fields, especially in the built environment.

## **SUMMARY**

In closing, Dr. Ashuri’s research, education, and services have had and continue to have a profound impact on both academic and professional communities of construction engineering and management. Dr. Ashuri’s research occupies a distinctive position in the Georgia Tech landscape, bridging the fields of building construction, civil and environmental engineering, economics, and operations research. Much of his research is characterized by the application of sophisticated statistical and econometric modeling methods to issues of practical interest to the construction industry and public agencies (notably departments of transportation) that engage in extensive construction. In many instances, he is the first, or among the few, to apply a given method to the context in question. This blend of methodological rigor and real-world relevance has made his work valuable to other scholars, to industry, and to the public sector.

Dr. Ashuri chaired the ASCE *Construction Research Council (CRC)* – the premier national and international forum for construction research that includes in its membership more than 400 professors and scholars – and led the CRC in its mission to “advance engineering knowledge and practice related to construction through stimulating and guiding research and assisting the financing thereof; interpret and promote the utilization of the findings of research for the construction industry; and identify future needs in the construction field and publicize them to stimulate appropriate research.” Promotion to full professor will place Dr. Ashuri in a statute concurrent to the expectation of his counterparts in similar key leadership positions in the research community.

Dr. Ashuri’s research productivity has increased significantly since he has been promoted to Associate Professor in 2014 (more than 70% of his research funding (more than \$4.85M) and approximately 70% of his papers). Dr. Ashuri will continue to contribute positively to Georgia Tech’s Strategic Goals – as described in the Georgia Tech Strategic Plan “Designing the Future” – through actively engaging himself and his students in transformative initiatives for interdisciplinary research and teaching that aim to enhance decision-making and risk management for sustainable buildings and infrastructure systems. Dr. Ashuri looks forward to accepting greater leadership roles at Georgia Tech through additional opportunities provided by promotion to full professor.