Michelle (Shelby) T. Bensi, Ph.D.

Assistant Professor
Department of Civil and Environmental Engineering · Center for Disaster Resilience · Center for Risk and Reliability
University of Maryland, College Park, MD 20742
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AREAS OF SPECIALIZATION

- Applications of probability and statistics in civil engineering
- Probabilistic assessment of natural hazards (e.g., seismic, coastal, inland flooding, severe weather)
- Probabilistic risk assessment and risk-informed applications
- Risk assessment and resilience of infrastructure and engineered systems
- Structural reliability and systems modeling
- Decision-support for applications involving civil infrastructure systems
- Application of machine learning and data analytics to civil engineering problems
- Bayesian networks and other applications of Bayesian methods

EDUCATION

University of California - Berkeley, Berkeley, California, 2010

- Ph.D. in Civil Engineering with Designated Emphasis in Computational Science and Engineering
- Concentration: Structural Engineering · Minors: Statistics and Risk Analysis
- Dissertation: "A Bayesian Network Methodology for Seismic Infrastructure Risk Assessment and Decision-Support" (Advisor: Professor Armen Der Kiureghian; Co-advisor: Professor Daniel Straub)

University of Delaware, Newark, Delaware, 2006

- Master of Applied Sciences in Applied Sciences - Civil Engineering
- Thesis: "Generalized Assessment of Bridge Vulnerability to Terrorist Threats: A Probabilistic Structural Analysis Based Approach" (Advisor: Professor Baidurya Bhattacharya)

University of Toledo, Toledo, Ohio, 2004

- Bachelor of Arts in Economics, *summa cum laude* · Minors: Mathematics and Political Science

APPOINTMENTS

University of Maryland, College Park (Aug. 2017 – Present)

- Assistant Professor, Department of Civil and Environmental Engineering
- Core faculty member, Center for Disaster Resilience; Affiliated faculty, Center for Risk and Reliability

U.S. Nuclear Regulatory Commission (2010-2017)

- Civil Engineer, Office of New Reactors (2012–2017)
- Acting Branch Chief, Office of New Reactors (Oct. 2016-Dec. 2016)
- Reliability and Risk Engineer, Office of Nuclear Regulatory Research (2010–2012)

University of California, Berkeley (2006-2010)

- Graduate Student Researcher and Graduate Student Instructor

University of Delaware (2004-2006)

- Research Assistant and Teaching Assistant

SELECTED PAPERS/PUBLICATIONS/PROCEEDINGS

Topical areas

Bayesian networks	Systems modeling	Probabilistic hazard analysis	Uncertainty analysis	Fragility	Decision-support
Risk analysis	Nuclear facilities	Natural & man-made hazards	Random fields	Statistics/Machine-Learning/ Econometrics	

Publications and proceedings

- Baecher, G., M. Bensi, A. Reilly, B. Phillips, L. Link, S. Knight, G. Galloway (2019). "Resiliently Engineered Flood and Hurricane Infrastructure: Principles to Guide the Next Generation of Engineers," *The Bridge*.

- Bensi, M., S. Mohammadi, S. Kao, S. DeNeale, M. Carr, J. Kanney (2019). "A Review of Available Methods for the Probabilistic Treatment of Coincident and Correlated Flood Mechanisms," *Transactions*, *SMiRT-25*, Charlotte, NC, Aug. 4-9.

- DeJesus Segarra, J., M. Bensi, M. Modarres (2019). "Incorporation of Spatial Variability of Ground Motions in a Seismic Multi-Unit Probabilistic Risk Assessment," Proceedings of 2019 International Topical Meeting on Probabilistic Safety Assessment and Analysis (PSA 2019).

- DeJesus Segarra, J., M. Bensi, M. Modarres (2018). "Framework for Modeling Ground Motion Variability at a Nuclear Power Plant Site for Use in a Seismic Multi-Unit Probabilistic Risk Assessment," Proceedings of Probabilistic Safety Assessment and Management (PSAM 14), September 2018, Los Angeles, CA.

- Groth, K., M. Bensi (2018). "Commentary on Use of Model-Augmented Data Analytics for Improved Operational Efficiency of Nuclear Power Plants." Proceedings of PSAM 14, September 2018, Los Angeles, CA.

- Bensi, M., R. Schneider, A. Mironenko, S. Loyd, Z. Ma (2017). "Revision and Expansion of ASME/ANS External Flooding PRA Standard," International Topical Meeting on Probabilistic Safety Assessment and Analysis, Sept. 24-28.

- Bensi, M., N. Chokshi, C. Cook, J. Kanney, C. Munson, M. Willingham (2017). "Plan to ensure ongoing assessment of natural hazard information at U.S. nuclear power plants." *Transactions*, *SMiRT-24*, Busan, Korea, Aug. 20-25.

- Flanders, C., N. Chokshi, M. Bensi, C. Munson, C. Cook, D. Jackson, A. Campbell, M. Willingham, J. Ake (2017). "Insights gained from post-Fukushima reviews of seismic and flooding hazards at operating U.S. nuclear power plants sites." *Transactions, SMiRT-24*, Busan, Korea, Aug. 20-25.

- N. Chokshi, M. Bensi, C. Cook, J. Cushing, A. Ghosh, B. Harvey, B. Hayes, D. Heeszel, and S. Tammara (2017). "United States Practice of Site Evaluation for Nuclear Power Plants." *Transactions, SMiRT-24*, Busan, Korea, Aug. 20-25.

- Bensi, M., J. Kanney (2015). "Development of a Framework for Probabilistic Storm Surge Hazard Assessment for United States Nuclear Power Plants," *Transactions*, *SMiRT-23*, Manchester, United Kingdom, Aug. 10-14.

- Bensi, M., J. Philip, F. Ferrante (2015). "Assessment of Flood Fragility for Nuclear Power Plants: Challenges and Next Steps," *Transactions, SMiRT-23*, Manchester, United Kingdom, Aug. 10-14.

- Bensi, M., A. Der Kiureghian, and D. Straub (2014). "Framework for Post-Earthquake Risk Assessment and Decision Making for Infrastructure Systems." *ASCE-ASME J. Risk Uncertainty Eng. Syst., Part A: Civ. Eng*. 1(1).

- Bensi, M., C. Cook, N. Chokshi (2013). "Integrated Assessment of Flooding Hazards at U.S. Nuclear Power Plants," *Transactions, SMiRT-22*, San Francisco, CA, Aug. 18-23.

- Bensi, M. (2013). "Contributions of Dam Failures to External Flood Hazard at Nuclear Power Plant Sites: Rationale and Path Forward," Proceedings of 8th Nuclear Plants Current Issues Symposium: Challenges & Opportunities, Orlando, FL, Jan. 23-25.

- Bensi, M., A. Der Kiureghian and D. Straub (2013). "Efficient Bayesian network modeling of systems." *Reliability Engineering and System Safety*, 112:200-213.

- Ferrante, F., M. Bensi, J. Mitman (2012). "Uncertainty Analysis for Large Dam Failure Frequencies," Proc. of 11th International Probabilistic Safety Assessment and Management Conference, Helsinki, Finland, June 25-29.

- Bensi, M., A. Der Kiureghian, D. Straub (2011). "Bayesian network modeling of correlated random variables drawn from a Gaussian random field." *Structural Safety*. 33: 317-332.

- Bensi, M., D. Black, M. Dowd (2004). "The Education/Growth Relationship: Evidence from Real State Panel Data," *Contemporary Economic Policy*.

Under review/revision

- Bensi, M., T. Weaver, "Evaluation of Tropical Cyclone Recurrence Rate: Factors Contributing to Epistemic Uncertainty."

- DeJesus Segarra, J., M. Bensi, T. Weaver, M. Modarres, "Extension of Probabilistic Seismic Hazard Analysis to Account for the Spatial Variability of Ground Motions at a Multi-Unit Nuclear Power Plant Site."

- Al Kajbaf, A., M. Bensi, "Application of Surrogate Models in Estimation of Storm Surge: A Comparative Assessment."

- Lingyao, L., M. Bensi, Q. Cui, G. Baecher, and Y. Huang, "Social media crowd-sourcing for rapid damage assessment following sudden-onset natural hazard events."

- Bensi, M., K. Groth, "Data Analytic Framework for Safety and Operational Efficiency of Nuclear Power Reactors."

Technical reports and other documents

- Bensi, M., A. Der Kiureghian, D. Straub (2011). "A Bayesian network methodology for infrastructure seismic risk assessment and decision support." Report No. 2011/02, Pacific Earthquake Engineering Research Center, University of California, Berkeley.
- Lead author or significant contributor to U.S. Nuclear Regulatory Commission (USNRC) regulatory guidance documents related to integrated assessment of plant response to flooding hazards, regulatory guidance documents related to assessment of coastal and dam failure hazards, and Commission policy papers

PROFESSIONAL AND RESEARCH EXPERIENCE SUMMARY

Michelle (Shelby) Bensi, Ph.D., currently serves as an assistant professor in the Department of Civil and Environmental Engineering at the University of Maryland (UMD). She is a core faculty member of the UMD Center for Disaster Resilience and an affiliated faculty member of the UMD Center for Risk and Reliability. Dr. Bensi's current research centers on the application of probabilistic risk assessment concepts and tools as well as statistical/machine learning techniques to problems involving engineered systems exposed to natural hazards. Dr. Bensi focuses primarily on topics related to the probabilistic assessment of natural hazards, risk-informed applications, and disaster resilience. Dr. Bensi works with a number of natural hazard groups (e.g., seismic, coastal, and fluvial flood hazards) as part of her research activities and aims to transfer knowledge and lessons across those conventional disciplinary divides.

In addition to research activities, Dr. Bensi is currently engaged in activities outside of the university. She serves as a member of the Department of Homeland Security Science and Technology Directorate's Flood Apex Review Board. The Review Board is responsible for the review of the scientific quality, novelty, and transition potential of research products. She also serves as a member of the American Nuclear Society and American Society of Mechanical Engineers (ANS/ASME) Joint Committee on Nuclear Risk Management and chairs the working gorup responsible for the ANS/ASME Standard for external flooding probabilistic risk assessment at nuclear power plants. Dr. Bensi has also served as a peer reviewer for nuclear power plant external flooding probabilistic risk assessment.

Prior to joining the UMD faculty, Dr. Bensi served as an engineer at the United States Nuclear Regulatory Commission where she was heavily involved in the agency response to the Fukushima Dai-ichi reactor accidents. She was also responsible for site-specific technical reviews involving assessment of natural hazards at new and operating reactors. She performed research and technical reviews related to flood hazard assessment and led development of technical guidance and novel frameworks for assessment of plant response to flooding hazards. In addition, Dr. Bensi prepared multiple policy papers and communicated complex technical material to internal parties (e.g., senior executives, the agency advisory committee, and the Commission) and external stakeholders (e.g., other government agencies, industry representatives, and members of the public). This experience in federal service has provided important context for Dr. Bensi's continued academic research pursuits.

Prior to joining the NRC, Dr. Bensi's doctoral research focused on the development of a Bayesian network (BN) framework for seismic infrastructure risk assessment and near-real-time, post-event decision support. The proposed BN framework consists of four distinct components: (1) seismic demand random field model, (2) models of the performance of point-site and continuous components, (3) formulations for modeling system performance, and (4) extension of the BN to solve decision problems through ranking of decision alternatives based on expected utility maximization. Given the memory demands associated with BNs, her research also addressed multiple computational tractability issues. Her master's research focused on the vulnerability of infrastructure systems (bridges) to man-made hazards through application of a probability-based (Monte Carlo) approach to assess structural performance. Dr. Bensi performed econometric research while pursuing her undergraduate degree.

TEACHING

University of Maryland, College Park (Assistant Professor)

- ENCE 302: Probability and Statistics for Civil and Environmental Engineers (Fall 2017; Spring 2018, Spring 2019)
- ENCE 688Q: Assessment of Natural Hazards for Engineering Applications (Fall 2018, Fall 2019)

University of California, Berkeley (Graduate Student Instructor)
- CE 193: Engineering Risk Analysis (Fall 2006, Fall 2008)
- CE 93: Engineering Data Analysis (Spring 2007, Spring 2008)

University of Delaware (Teaching Assistant)

- CIEG 315: Probability and Statistics for Engineers

European School of Advanced Studies in Reduction of Seismic Risk (ROSE School), Italy (Teaching Assistant)
- Seismic Reliability of Structures (June 2009)

SELECTED AWARDS

- ASME, Joint Committee on Nuclear Risk Management, Certificate of Acclamation, 2017
- U.S. NRC Special Act Awards (2014: 2 awards; 2016: 2 awards)
- U.S. NRC Performance Awards (2011-2017)
- U.S. NRC Vision of Success Award (2014)
- U.S. NRC Division of Site Safety and Environmental Analysis Global Communicator Award (2016)
- National Science Foundation Graduate Research Fellowship

SERVICE AND RELATED ACTIVITIES

Department and University Activities

- Department Merit Review Committee (2017/18 academic year)
- Department Strategic Planning Committee (current)
- Graduate School English Proficiency Committee (2019)
- Developing resilience engineering curriculum (ongoing)
- Currently advising nine student researchers (graduate and undergraduate)
  - Current PhD Students: 6
  - Current Masters Students: 1
  - Current undergraduate researchers: 2

External Service Activities and Engagement

- Department of Homeland Security Flood Apex Research Review Board
- ANS/ASME Joint Committee on Nuclear Risk Management
  - JCNRM full committee member
  - Working Group 8 Chair (External Flooding PRA Standard)
- Reviewer for: ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part A: Civil Engineering; KSCE Journal of Civil Engineering; IEEE Transactions; Journal of Infrastructure Systems; Computer Methods in Applied Mechanics and Engineering; Natural Hazards; Journal of Waterway, Port, Coastal, and Ocean Engineering; Reliability Engineering and System Safety; Risk Analysis
- Conference Technical/Organizing Committee Membership: 2018 Probabilistic Safety Assessment & Management (PSAM) Conference, 2019 International Topical Meeting on Probabilistic Safety Assessment and Analysis (PSA 2019)

SELECTED PROFESSIONAL DEVELOPMENT

- Basics of Coastal Processes for Engineers/Planners (2017)
- U.S. NRC HEC-RAS training (2017)
- Introduction to Hydraulic & Hydrologic Modeling (2016)
- Flood Frequency Analysis (2016)
- ADCIRC Boot Camp (2015)
- Seismic PRA/Seismic Margin Assessment Methods (2014)
- SAPHIRE Basics (2013)
- NRC/EPRI Fire PRA Course - Human Reliability Analysis Module (2012)
- Perspectives on Reactor Safety (2012)
- Introductory Health Physics (2012)
- Best Practices in Dam Safety Risk Analysis (2011)
- Seismic Probabilistic Risk Assessment Training (2011)
- Westinghouse pressurized water reactor training series, including simulator (2011)
- Power Plant Engineering (2011)