

FERNANDA CRUZ RIOS, PHD

Civil and Environmental Engineering
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CAREER SUMMARY

Research

- Main research expertise: circular economy in the built environment.
- Other research interests: diversity and inclusion in higher education; social justice and equity in the built environment; social and environmental life cycle assessments; social aspects of sustainability; circular cities; complex systems; convergence research.
- Published 18 peer reviewed publications: 9 journal articles, 9 conference papers.
- Convergence research: Co-coordinated a team of 22 researchers (8 faculty, 2 postdocs, 8 graduate students, and 4 undergraduate students), proposed convergent activities, team dynamics, and facilitated team discussions around the circular economy.
- Participated in the organization committee of the Virtual Convergence Accelerator Workshop: Design for a Circular Economy from Molecules to the Built Environment, an NSF-funded event for 100 invited experts in circular economy worldwide.

Diversity, Equity, and Inclusion

- Investigated barriers faced by Native American engineering students and proposed a framework to advance the recruitment and retention of Native American students and faculty in engineering.
- Interviewed 22 engineering Deans across the U.S. to understand institutional diversity and inclusion practices and their effect on Native American engineering students.
- Participated in the development of Achieve60AZ (now Education Forward Arizona), an organization that aims at reaching 60 percent postsecondary attainment in Arizona with focus on underrepresented populations.
- Investigated inequalities concerning women in construction trades: published a journal article about gender-specific workplace safety issues and attended to the 2016 Women Build Nations Conference in Chicago, IL, where over 1,000 tradeswomen gathered to build community, foster learning and leadership development, share personal struggles and victories in the workplace, and celebrate diversity.

Teaching

- Created and taught a circular economy educational module with online classes and assignments for an advanced graduate course and two undergraduate courses at Swanson School of Engineering at the University of Pittsburgh.
- Co-created and instructed a multidisciplinary design studio to generate solutions for circular economy in a Living Building project.
- Received a Teaching Assistantship award.

EDUCATION

Ph.D.	Civil, Environmental, and Sustainable Engineering	Arizona State University	2018
BS	Architecture and Urban Planning	Universidade Federal da Bahia	2012

JOURNAL PUBLICATIONS

Dr. Cruz Rios has published 9 journal articles since 2017. She has also published 9 peer-reviewed conference papers, 2 reports, and 1 book chapter.

Accepted/Published

9. Babbitt, C., Athaf, S., Graedel, T., **Cruz Rios, F.**, & Bilec, M. (2021). The role of design in circular economy solutions for critical materials. *One Earth* (Cell Press), 4 (3), 353-362. <https://doi.org/10.1016/j.oneear.2021.02.014>
8. **Cruz Rios, F.**, Grau, D., & Bilec, M. (2021) Barriers and Enablers to Circular Building Design in the U.S.: An Empirical Study. *Journal of Construction Engineering and Management*, 147 (10), 04021117. [https://doi.org/10.1061/\(ASCE\)CO.1943-7862.0002109](https://doi.org/10.1061/(ASCE)CO.1943-7862.0002109)
7. Grau, D., **Cruz-Rios, F.**, and Sherman, R. (2021). Project Validation: A Set-Based and Concurrent Design Approach to Inform Owner's Authorization Decision on Complex Projects. *Journal of Construction Engineering and Management, Special issue on Construction Research Congress 2020*, 147(10), 04021 132-1 to -10. [https://doi.org/10.1061/\(ASCE\)CO.1943-7862.0002152](https://doi.org/10.1061/(ASCE)CO.1943-7862.0002152)
6. **Cruz Rios, F.**, Panic, S., Grau, D., Khanna, V., & Bilec, M. (in press). Exploring circular economies in the built environment from a complex systems perspective: A systematic review and conceptual model at the city scale. *Sustainable Cities and Society*, 103411. <https://doi.org/10.1016/j.scs.2021.103411>
5. Berry, B., Farber, B., Chakraborty, S., Haedicke, M., Lowden, S., **Cruz Rios, F.**, Bilec, M., & Isenhour, C. (in press). Just by Design? Exploring justice as a multidimensional concept in U.S. circular economy discourse. *Local Environment*.
4. **Cruz Rios, F.**, Naganathan, H., Tello, L., Adams, S., Cook-Davis, A., El Asmar, M., Grau, D., & Parrish, K. (2020). Catalysts and Barriers Faced by Native American Engineering Undergraduate Students in Arizona. *Journal of Civil Engineering Education*, 147 (2). [https://doi.org/10.1061/\(ASCE\)EI.2643-9115.0000033](https://doi.org/10.1061/(ASCE)EI.2643-9115.0000033)
3. **Cruz Rios, F.**, Grau, D., & Chong, W. K. (2019). Reusing exterior wall framing systems: A cradle-to-cradle comparative life cycle assessment. *Waste Management*, 94, 120–135. <https://doi.org/10.1016/j.wasman.2019.05.040>
2. **Cruz Rios, F.**, Chong, W. K., & Grau, D. (2017). The need for detailed gender-specific occupational safety analysis. *Journal of Safety Research*, 62, 53–62. <https://doi.org/10.1016/j.jsr.2017.06.002>
1. **Cruz Rios, F.**, Naganathan, H., Chong, O., Lee, S., & Alves, A. (2017). Analyzing the Impact of Outside Temperature on Energy Consumption and Production Patterns in High-Performance Research Buildings in Arizona. *Journal of Architectural Engineering*, 23(3), [C4017002]. [https://doi.org/10.1061/\(ASCE\)AE.1943-5568.0000242](https://doi.org/10.1061/(ASCE)AE.1943-5568.0000242)

DOCTORAL DISSERTATION

Cruz Rios, F. (2018). Beyond Recycling: Design for Disassembly, Reuse, and Circular Economy in the Built Environment. *Ph.D. Dissertation*, Arizona State University.

CONFERENCE PAPERS

9. **Cruz Rios, F.**, Berry, B., Zappitelli, J., Khanna, V., Isenhour, C., Bilec, M. M. (2021). Why Bother? Environmental and social implications of using durable building products. 4th *PLATE 2021 Conference Proceedings*, Product Lifetimes and the Environment. <http://hdl.handle.net/10344/10204>
8. **Cruz Rios, F.**, & Grau, D. (2020). Design for Disassembly: An analysis of the practice (or lack thereof) in the United States. In *Construction Research Congress 2020*. American Society of Civil Engineers. <https://doi.org/10.1061/9780784482889.105>
7. **Cruz Rios, F.**, El Asmar, M., Grau, D., & Parrish, K. (2020). Hiring Native American Faculty in Engineering and Construction: Challenges from an Institutional Perspective. In *Construction Research Congress 2020*. American Society of Civil Engineers. <https://doi.org/10.1061/9780784482872.084>
6. Grau, D., Sherman, R., & **Cruz Rios, F.** (2020). Project Validation—Informing Client’s Approval Decision and Enhancing Project Performance. In *Construction Research Congress 2020*. American Society of Civil Engineers. <https://doi.org/10.1061/9780784482889.017>
5. Grau, D., **Cruz Rios, F.**, and Sherman, R. (2019). Project Validation – A Novel Practice to Improve Value and Project Performance. In: *Proc. 27th Annual Conference of the International Group for Lean Construction (IGLC)*, Pasquire C. and Hamzeh F.R. (ed.), Dublin, Ireland, pp. 63-72.
4. **Cruz Rios, F.**, Grau, D., & Chong, W. K. (2018). Steel or Wood Frame? A Life Cycle Comparison of External Wall Systems through Deconstruction and Reuse. In *Construction Research Congress 2018*. American Society of Civil Engineers. <https://doi.org/10.1061/9780784481301.048>
3. **Cruz Rios, F.**, Parrish, K., & Chong, W. K. (2016). Low-Investment Energy Retrofit Framework for Small and Medium Office Buildings. *Procedia Engineering*, 145, 172–179. <https://doi.org/10.1016/j.proeng.2016.04.057>
2. **Cruz Rios, F.**, Chong, W. K., & Grau, D. (2016). Women and Accidents: The Need to Separate Gender Database. *Procedia Engineering*, 145, 662–669. <https://doi.org/10.1016/j.proeng.2016.04.061>
1. **Cruz Rios, F.**, Chong, W. K., & Grau, D. (2015). Design for Disassembly and Deconstruction - Challenges and Opportunities. *Procedia Engineering*, 118, 1296–1304. <https://doi.org/10.1016/j.proeng.2015.08.485>

OTHER PUBLICATIONS

3. Bilec, M., Beckman, E., Jambeck, J., Locklin, J., Jiang, G., & **Cruz Rios, F.** (2020). NSF Convergence Accelerator: Design for Circular Economy from Molecules to the Built Environment Workshop Report. Submitted to the National Science Foundation, Award No. 2035223.
2. **Cruz Rios, F.**, & Grau, D. (2019). Circular Economy in the Built Environment: Designing, Deconstructing, and Leasing Reusable Products. In *Reference Module in Materials Science and Materials Engineering*. Elsevier. <https://doi.org/10.1016/b978-0-12-803581-8.11494-8>
1. Grau, D., **Cruz Rios, F.**, and Sherman, R. (2019). Project Validation: A Guide to Improving Owner Value and Team Performance. Submitted to the Lean Construction Institute.

PRESENTATIONS AND POSTERS

Dr. Cruz Rios has participated in 12 conference presentations, 1 keynote presentation, and 2 conference posters since 2015.

15. **Cruz Rios, F.**, Grau, D., & Bilec, M.M. (2021). Barriers and Enablers to Circular Building Design in the U.S.: An Empirical Study. Presentation, International Symposium on Sustainable Systems and Technology (ISSST), June 21-24, 2021 (held virtual).
14. **Cruz Rios, F.**, & Bilec, M.M. (2021). Circular Urban Systems: Circular Economy in the Built Environment from a Systems Perspective. Poster, International Symposium on Sustainable Systems and Technology (ISSST), June 21-24, 2021 (held virtual).
13. **Cruz Rios, F.** (2021). From the trenches: Convergence research in practice as told by a postdoc. Part of the “Convergence in Action” panel organized by Gemma Jiang, Linda Molnar, Fernanda Cruz Rios, and Melissa Bilec. 12th Annual International Science of Team Science (SciTS) Conference, June 7-11, 2021 (held virtual).
12. **Cruz Rios, F.**, Berry, B., Isenhour, C., Zappitelli, J., Khanna, V., & Bilec, M.M. (2021). Why bother? Environmental and social implications of using durable building products. Presentation, Product Lifetime and the Environment (PLATE) Conference, May 26-28, 2021 (held virtual).
11. **Cruz Rios, F.**, Bilec, M.M., Gardner, H., Khanna, V., Theis, T. (2021). Circular Design and Embodied Carbon in Living Buildings: A Case Study. Presentation, ASCE Architectural Engineering Institute (AEI) Conference, April 7-9, 2021 (held virtual).
10. Bilec, M.M., & **Cruz Rios, F.**, (2020). Converging on Circular Economy Solutions for the Built Environment. Keynote presented by Dr. Melissa Bilec at the International Congress on Sustainability Science & Engineering, August 3-5, 2020, Denver, Colorado (held virtual).
9. **Cruz Rios, F.**, & Grau, D. (2020). Design for Disassembly: An analysis of the practice (or lack thereof) in the United States. Presentation, Construction Research Congress 2020, organized by the American Society of Civil Engineers, March 8 – 10, 2020, Tempe, Arizona.
8. **Cruz Rios, F.**, El Asmar, M., Grau, D., & Parrish, K. (2020). Hiring Native American Faculty in Engineering and Construction: Challenges from an Institutional Perspective. Presentation, Construction Research Congress 2020, organized by the American Society of Civil Engineers, March 8 – 10, 2020, Tempe, Arizona.
7. Grau, D., Sherman, R., & **Cruz Rios, F.** (2020). Project Validation—Informing Client’s Approval Decision and Enhancing Project Performance. Presentation, Construction Research Congress 2020, organized by the American Society of Civil Engineers, March 8 – 10, 2020, Tempe, Arizona.
6. **Cruz Rios, F.**, El Asmar, M., Grau, D., & Parrish, K. (2019). Native American Attainment in Engineering Education: The Role of Universities. Poster, NSF Engineering Education and Centers Grantees Conference, October 21 – 23, 2019, Arlington, Virginia.
<https://doi.org/10.13140/RG.2.2.10474.13763>
5. Grau, D., **Cruz Rios, F.**, and Sherman, R. (2019). Project Validation – A Novel Practice to Improve Value and Project Performance. Presentation, 27th Annual Conference of the International Group for Lean Construction (IGLC), July 1 – 7, 2019, Dublin, Ireland.

4. **Cruz Rios, F.**, Grau, D., & Chong, W. K. (2018). Steel or Wood Frame? A Life Cycle Comparison of External Wall Systems through Deconstruction and Reuse. Presentation, Construction Research Congress 2018, organized by the American Society of Civil Engineers, April 2 – 4, 2018, New Orleans, Louisiana.
3. **Cruz Rios, F.**, Parrish, K., & Chong, W. K. (2016). Low-Investment Energy Retrofit Framework for Small and Medium Office Buildings. Presentation, International Conference on Sustainable Design, Engineering, and Construction, May 18 – 20, 2016, Tempe, Arizona.
2. **Cruz Rios, F.**, Chong, W. K., & Grau, D. (2016). Women and Accidents: The Need to Separate Gender Database. Presentation, International Conference on Sustainable Design, Engineering, and Construction, May 18 – 20, 2016, Tempe, Arizona.
1. **Cruz Rios, F.**, Chong, W. K., & Grau, D. (2015). Design for Disassembly and Deconstruction - Challenges and Opportunities. Presentation, International Conference on Sustainable Design, Engineering, and Construction, May 10 – 13, 2015, Chicago, Illinois.

RESEARCH EXPERIENCE

Dr. Cruz Rios has over 7 years' experience in academic research. She has worked on 2 postdoctoral appointments (18 months each). During her doctorate, she held 2 research assistant positions, in addition to her dissertation research.

Postdoctoral Researcher

2020-2021

Mascaro Center for Sustainable Innovation,
University of Pittsburgh
Advisor: Dr. Melissa Bilec.

- Conducted innovative and transdisciplinary research on Circular Economy in various sectors, with a focus in the built environment. (NSF Award # 1934824).
- Identified the main factors surrounding the Circular Economy concept and implementation, such as barriers, drivers, possible solutions, technologies, design strategies, policy instruments, educational gaps, circularity indicators, environmental assessment methods, societal and behavioral factors.
- Co-created a new definition and vocabulary around the Circular Economy.
- Co-coordinated a team of 22 researchers (8 faculty, 2 postdocs, 8 graduate students, and 4 undergraduate students).
- Participated in the organization committee of the Virtual Convergence Accelerator Workshop: Design for a Circular Economy from Molecules to the Built Environment, an event for 100 invited experts in Circular Economy worldwide.
- Created and taught a Circular Economy educational module with online classes and assignments for an advanced graduate course (Advanced Life Cycle Assessment) and two undergraduate courses (Engineering and Sustainable Development, and Advanced Green Building and Construction) at Swanson School of Engineering at the University of Pittsburgh.
- Graded exams for the two courses mentioned above.
- Proposed convergent activities, team dynamics, and facilitate team discussions around the Circular Economy.
- Co-created the project website.
- Participated in professional development opportunities (e.g., Present Your Science workshop; The Postdoc Academy course).

- Developed journal articles for publication in prominent journals.
- Reported research progress to the National Science Foundation.
- Co-coordinated the efforts to and participated in the Reverse Site Visit held by the National Science Foundation.

Postdoctoral Researcher

2018-2019

School of Sustainable Engineering and the Built Environment,
Arizona State University

Advisors: Dr. Kristen Parrish, Dr. Mounir El Asmar, and Dr. David Grau.

- Identified barriers and catalysts faced by Native American engineering students and their impact on Native American persistence in postsecondary education based on qualitative research protocols.
- Conducted primary source research through interviews with 22 engineering Deans across the U.S. to identify the challenges of hiring Native American faculty.
- Proposed solutions and best practices to advance the recruitment and retention of Native American students and faculty in engineering.
- Participated in roundtables with members of Native American tribal communities and education stakeholders to collaborate in a bottom-up goal and strategy setting led by [Achieve60AZ](#), an organization that aims at reaching 60 percent postsecondary attainment in Arizona with focus on underrepresented populations.
- Reported research progress to the National Science Foundation.

Doctoral Researcher

2014-2018

*School of Sustainable Engineering and the Built Environment,
Arizona State University*

Advisors: Dr. David Grau and Dr. Oswald Chong

- Employed quantitative and qualitative analysis methods to investigate the state-of-the-art of Design for Disassembly and materials reuse in the U.S.
- Conducted primary source research through interviews with architects across the U.S.
- Conducted Life Cycle Assessment (LCA) to compare single-use building materials against reusable building materials
- Published articles in building materials reuse, Design for Disassembly, circular economy, construction safety, energy retrofit, and energy efficiency
- Participated in consulting teams to propose innovative sustainability strategies to clients like MillerCoors, Make it Circular LLC, Liberty Wildlife Foundation, and the City of Phoenix. The strategies were based on net-positive energy, water, and waste.

Research Assistant

2018-2019

Lean Construction Institute (partnership with the School of Sustainable Engineering and the Built Environment, coordinated by Dr. David Grau)

- Conducted primary source research through interviews with construction stakeholders and building owners to define standards for implementing project validation, an emergent practice in the construction industry.
- Analyzed quantitative and qualitative data to understand the state-of-the-art of Project Validation in the U.S.
- Co-developed a Project Validation guide published by the Lean Construction Institute.

ASU Walton Sustainability Solutions Initiative

2014-2015

- Presented the Department of Energy (DOE)'s Building Asset score to the City of Scottsdale, AZ.
- Completed Asset Score protocol for multiple buildings in Scottsdale, AZ.

TEACHING EXPERIENCE

Course Co-Instructor

2020.1, 2020.2, 2021.1

Swanson School of Engineering at the University of Pittsburgh

- Developed and taught a Circular Economy module, and assisted with grading for the courses below:
 - CEE 1610/2610 – Engineering and Sustainable Development
 - CEE 2620 – Advanced Green Building Design and Construction
 - CEE 3609 – Advanced Life Cycle Assessment

Course Instructor

2018.2

School of Sustainability at Arizona State University

- Taught SOS 498/594 *Creating a Living Building*, a combined undergraduate and graduate seminar (averaging 20 students from diverse backgrounds) that covered the principles of the Living Building Challenge. The Living Building Challenge is considered the most demanding green building certification in the planet and covers topics such as energy use, building materials, water use, equity, beauty, building site and urban structure, biophilic design, and building occupants health and productivity.
- Developed exams and homework.
- Revised and adapted the Syllabus.
- Invited guest speakers and coordinated class discussions and site visits.
- Coordinated grading.
- Coordinated team development and dynamics.

Teaching Assistant

2017.2

School of Sustainability at Arizona State University

- Course: SOS 498/594 *Creating a Living Building*.
- Led the conceptual design of an innovative building whose owner aimed at earning the Living Building Challenge certification.
- Earned the Mortenson Teaching Assistantship Award.

HONORS AND AWARDS

Mortenson Teaching Assistantship Award

2018

Granted by the School of Sustainability at Arizona State University

Laspau/Science Without Borders Scholarship

2014

Scholarship and fellowship for placement in a PhD program at the United States. Granted by the Ministry of Education of Brazil and Laspau (affiliated with Harvard University)

Best Residential Construction Award

2014

Issued by the Brazilian Association of Architectural Firms (AsBEA) for the "Do Bomba House" project.

PROFESSIONAL SERVICE

Journal Reviewer	2020 - Present
<i>International Journal of Life Cycle Assessment</i>	
<i>Journal of Industrial Ecology</i>	
<i>Journal of Architectural Engineering</i>	
<i>Resources, Conservation, and Recycling</i>	
Conference Reviewer	2021
<i>International Symposium for Sustainable Systems and Technology (ISSST) 2021</i>	
Conference Reviewer	2020
<i>Construction Research Conference (CRC) 2020.</i>	
Conference Student Organizer	2015 and 2016
<i>International Conference on Sustainable Design, Engineering, and Construction (ICSDEC).</i>	

INDUSTRY EXPERIENCE

Associate Architect	2013-2014
<i>Sotero Arquitetos, Salvador BA, Brazil</i>	
<ul style="list-style-type: none"> • Designed and coordinated architectural projects ranging from residential, commercial, industrial, and institutional buildings, both public and private. • Prepared presentations for clients and investors. 	
Architect Intern	2011-2012
<i>Caramelo Arquitetos Associados, Salvador BA, Brazil</i>	
<ul style="list-style-type: none"> • Developed architectural drawings for commercial and residential buildings. • Managed MEP coordination services. • Led a project team to accomplish complex project goals and deadlines. 	