Bhushan Raj Selvaraj

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EDUCATION

Doctor of Philosophy in Civil Engineering 2021 - 2025
The University of Texas at Austin, Austin, TX

Dissertation:	"Analysis and Design of I-Girder Bridges for Heavy Deck Overhang Loads"
Academic Advisors:	Dr. Todd Helwig and Dr. Eric Williamson

Master of Technology in Civil Engineering 2013 - 2015
Indian Institute of Technology Kanpur, India

Thesis:	"Analytical Out-of-Plane Response of Fabric Reinforced Cementitious Matrix (FRCM) Strengthened Masonry-Infilled Reinforced Concrete Frames with Prior In-Plane Damage"
Academic Advisor:	Dr. Durgesh C. Rai

B.E. Civil Engineering May 2013
Anna University, India

RESEARCH EXPERIENCE

Graduate Research Assistant, The University of Texas at Austin
Department of Civil, Architectural and Environmental Engineering, Austin, TX

TxDOT Project 0-7115: Investigate Live Load Distribution and Stability of Prestressed Concrete Girder During Construction September 2024 – May 2025
Advisors: Dr. Todd Helwig and Dr. Michael Hebdon

- *Research Summary:*
  - Performed influence surface analysis on a wide range of spliced-girder bridges using Python scripts in Abaqus
  - Developed a live load optimization program to identify critical positions of AASHTO HL-93 and calculate live load distribution factors
  - Studied the effects of diaphragm layouts, skewed supports, haunched girders at interior supports on live load effects in spliced-girder bridges
  - Supported the analytical studies on stability of spliced-girder bridges by providing helpful feedback on buckling analysis and nonlinear analysis

TxDOT Project 0-7116: Develop Deck and Overhang Design Guidelines for Sound Walls and Other Heavy Loads August 2021 – August 2024
Advisors: Dr. Todd Helwig, Dr. Eric Williamson and Dr. Michael Engelhardt

- *Research Summary:*
  - Developed finite element models of concrete and steel I-girder bridges and studied the distribution of railing dead loads

- Conducted a rigorous parametric study for a wide range of bridge systems utilizing python scripts on high-performance computing systems
- Developed simple equations for railing load distribution factors using *PySR*, a machine-learning-based symbolic regression program
- Evaluated deck overhangs supporting heavy railings for strength and serviceability criteria

TxDOT Project 0-7016: Develop Guidance for Structural Behavior of Tall Haunches in TxDOT Beam and Girder Bridges January 2021 – August 2021
Advisors: Dr. Eric Williamson, Dr. Todd Helwig, & Dr. Michael Engelhardt

– *Research Summary:*
  - Performed push-out tests of composite beam and slab specimens to study the shear behavior of composite girder bridges with tall haunches (connecting girder and slab)
  - Developed finite element models of tall-haunch push-out test specimens with shear studs in regular and stacked arrangement
  - Validated the models with experimental results and improved accuracy

Graduate Student Researcher, Indian Institute of Technology Kanpur
Department of Civil Engineering, Kanpur, India

Seismic Performance of Fabric Reinforced Cementitious Matrix (FRCM) Strengthened Masonry Infilled Reinforced Concrete Frames May 2014 to Oct 2015
Advisor: Dr. Durgesh C. Rai

– *Research Summary:*
  - Developed and validated a finite element model of FRCM strengthened masonry in Abaqus program
  - Studied interaction of in-plane damage on out-of-plane strength of masonry infills under seismic forces
  - Developed a framework for performance-based seismic design of FRCM strengthened masonry infills in a full-scale RC frame including bi-directional behavior

This work resulted in a publication in a journal (first author) and a book chapter.

Reconnaissance Survey of 2015 Gorkha Earthquake May 2015 to June 2015
Advisor: Dr. Durgesh C. Rai

– *Research Summary:*
  - Surveyed earthquake affected regions of Nepal and India after the Gorkha Earthquake on April 25, 2015
  - Correlated the location of severe damages with geological studies, identified structural defects responsible for collapse/damage, assessed the compliance to local code provisions

This work resulted in three publications and received press attention in India. The research was funded by the *Poonam and Prabhu Goel Foundation* at IIT Kanpur.

TEACHING EXPERIENCE

Teaching Assistant, The University of Texas at Austin
Department of Civil, Architectural and Environmental Engineering, Austin, TX

CE 324P - Properties and Behavior of Engineering Materials Spring 2021
Instructor: Dr. Sanjida Ahsan / Dr. Maria Juenger

CE 311K - Introduction to Computer Methods Spring 2021
Instructor: Dr. Christian Claudel

Teaching Assistant, Indian Institute of Technology Kanpur
Department of Civil Engineering, Kanpur, India

CE 242 - Civil Engineering Materials Spring 2015
Instructor: Dr. Sudhir Misra

ESO 218 - Computational Methods in Engineering Fall 2014
Instructor: Dr. Sudib Kumar Mishra

Key Responsibilities:

- Taught laboratory sessions in undergraduate courses on testing of construction materials and introduction to computer programming
- Teaching techniques revolved around students' understanding of the purpose of the experiments or programs and connected with real-world applications

PROFESSIONAL EXPERIENCE

10-4 Engineering PLLC
Chicago, IL

Structural Engineer June 2025 - Present

Key Responsibilities:

- Advanced analysis of aerial guideway structures with light-rail transit loads
- Perform rail-structure interaction analysis, vehicle-structure interaction analysis and develop design calculations
- Mentor younger engineers to develop skills and teach advanced concepts

Key Project:

- Open-deck steel girder guideway structures in Red Line Extension (RLE) of Chicago Transit Authority

Larsen & Toubro Construction
Mumbai, India

Assistant Engineering Manager January 2018 – December 2020

Senior Design Engineer November 2016 – December 2017

Post-graduate Engineering Trainee November 2015 – November 2016

Key Responsibilities:

- Design of bridges and structures in roads, railways and airport projects
- Cost optimization by adopting bridge types for accelerated construction and digital methods for fast-track designs
- Conceptual and preliminary designs for securing projects in tender stage
- Coordinate between engineers of other disciplines and construction team to ensure successful completion of infrastructure projects

Key Projects:

- Taxiway Bridge at Delhi International Airport – the longest integral-type taxiway bridge (4 x 30m + 26m) in India

- Design optimization of a curved box girder bridge (46m + 60m + 46m) with integral piers
- Blast analysis of box-type taxiway underpass for Bangalore International Airport
- Design of substructures and foundations of major river bridges for expressway projects in various parts of India
- Developed scripts to automate grillage analysis of curved I-girder bridges and post-processing of analysis results

PUBLICATIONS

Peer-Reviewed Research Articles

[3] **Selvaraj, B. R.**, and D.C. Rai. 2022. "Effect of In-Plane Damage on Out-of-Plane Response of FRCM Strengthened Masonry Infilled RC Frames." *Journal of Composites for Construction*, 26 (6): 04022070. American Society of Civil Engineers. https://doi.org/10.1061/(ASCE)CC.1943-5614.0001250.

[2] Rai, D. C., V. Singhal, **B. Raj S.**, and S. L. Sagar. 2016. "Reconnaissance of the effects of the M7.8 Gorkha (Nepal) earthquake of April 25, 2015." *Geomatics, Natural Hazards and Risk*, 7 (1): 1–17. Taylor & Francis. https://doi.org/10.1080/19475705.2015.1084955.

[1] Rai, D. C., V. Singhal, **S. B. Raj**, and S. L. Sagar. 2015. "Performance of residential buildings during the M 7.8 Gorkha (Nepal) earthquake of 25 April 2015." *Current Science*, 109 (11): 2126–2135. Current Science Association. https://www.jstor.org/stable/24906714.

Technical Reports

[2] Aliasghar-Mamaghani, M., A. Bjelland, P. Tackett, B. Koyuk, **B.R. Selvaraj,** T. Ngamjarungjit, R. Stevens, T. Helwig, and M. Hebdon. 2025. *Investigate Live Load Distribution and Stability of Prestressed Concrete Girder During Construction.* Austin, TX: Center for Transportation. [In print]

[1] **Selvaraj, B.R.,** T. Ngamjarungjit, A. Bjelland, T. Helwig, E. Williamson, and M. Engelhardt. 2024. *Develop Deck and Overhang Design Guidelines for Sound Walls and Other Heavy Loads.* Austin, TX: Center for Transportation. [In print]

Book Chapters

[1] Rai, D. C., **B. R. Selvaraj**, and L. Sagar. 2021. "Masonry-Infilled RC Frames Strengthened with Fabric-Reinforced Cementitious Matrix." *Emerging Trends of Advanced Composite Materials in Structural Applications*, S. B. Singh, M. V. R. Sivasubramanian, and H. Chawla, eds., 31–65. Singapore: Springer Singapore. https://doi.org/10.1007/978-981-16-1688-4_2

Conference Papers

[1] Rai, D. C., Singhal, V., **Bhushan Raj, S**. and Lalit Sagar, S. (2017). "Performance of residential buildings during M7.8 Gorkha (Nepal) earthquake of April 25, 2015." *16th World Conference on Earthquake Engineering*, Jan. 9-13, Santiago, Chile, Paper no. 4210.

PRESENTATIONS

Oral Presentations

[2] **Selvaraj, B. R.** "Analysis and Design of Integral Bridge in Delhi International Airport." Seminar of Engineering Design and Research Center, Larsen & Toubro Construction. Mumbai, India. October 2019.

[1] **Selvaraj, B. R.** "Bi-directional Loading in Masonry Infilled Frames." Earthquake Engineering Literature Survey Workshop for Post Graduate Students from Engineering Colleges across India at IIT Kanpur. Kanpur, India. June 2015.

Poster Presentations

[2] **Selvaraj, B. R.,** and Ngamjarungjit, T. "Effect of Heavy Railings in Girder Design." 2024 International Bridge Conference. San Antonio, TX. March 2024.

[1] **Selvaraj, B. R.,** and Ngamjarungjit, T. "Develop Deck and Overhang Design Guidelines for Heavy Loads." 2023 Forensics Engineering Conference. Austin, TX. February 2023.

HONORS AND AWARDS

Joseph A. Yura Structural Engineering Research Prize 2025
Texas Structural Steel Institute (for outstanding dissertation)

J. Neils Thompson Graduate Fellowship in Structural Engineering 2024
The University of Texas at Austin ($2,200 award)

John E. Breen Endowed Presidential Fellowship in Structural Engineering 2023
The University of Texas at Austin ($4,300 award)

John A. Focht Endowed Presidential Graduate Scholarship in Civil Engineering 2021
The University of Texas at Austin ($2,500 award)

Graduate Scholarship 2013 - 2015
Government of India (funded graduate studies at IIT Kanpur)

CERTIFICATIONS AND PROFESSIONAL REGISTRATIONS

Structural Engineering Intern 2025 - Current
Illinois Department of Financial and Professional Regulation, No. 082 000236

Engineer-In-Training 2022 - Current
Texas Board of Professional Engineers and Land Surveyors, No. 75040

Teaching Preparation Series Spring 2025
Center for Teaching and Learning, The University of Texas at Austin

PE Civil Structural Exam April 2024
National Council of Examiners for Engineering and Surveying

ACADEMIC SERVICE

President, EERI Student Chapter 2022 - 2025
The University of Texas at Austin

Judge, Capital of Texas Undergraduate Research Conference, Austin, TX 2023

Core Curriculum Assessment Grader June 2023
School of Undergraduate Studies, The University of Texas at Austin

REFERENCES

Todd Helwig, Ph.D.
Professor
Department of Civil, Architectural and Environmental Engineering
The University of Texas at Austin
thelwig@mail.utexas.edu
(Dissertation Co-Supervisor)

Eric Williamson, Ph.D.
Professor of Civil Engineering
United States Military Academy at West Point
eric.williamson@westpoint.edu
(Dissertation Co-Supervisor)

Michael Engelhardt, Ph.D.
Professor Emeritus
Department of Civil, Architectural and Environmental Engineering
The University of Texas at Austin
mde@mail.utexas.edu
(Dissertation Committee Member)

Durgesh C. Rai, Ph.D.
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(Graduate Research Advisor)