RAJAT VERMA

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RESEARCH INTERESTS

Transportation equity, accessibility, urban planning, travel behavior, human mobility.

EDUCATION

Purdue University *West Lafayette, IN*
Ph.D., Civil Engineering. Current GPA: 4.0. 8/2019 – 7/2024 (expecting)
Advisor: Dr. Satish V. Ukkusuri
Dissertation: *Advancing the quantitative assesment of transportation equity for planning.*

Michigan State University *East Lansing, MI*
Master of Science, Civil Engineering. GPA: 4.0 8/2017 – 5/2019
Advisor: Dr. Timothy J. Gates
Thesis: *Evaluation of a rear-end collision avoidance system on winter maintenance trucks.*

Indian Institute of Technology Roorkee *Roorkee, India*
Bachelor of Technology, Civil Engineering. GPA: 8.64/10 7/2013 – 5/2017
Academic advisor: Dr. Indrajit Ghosh
Major project: *Design of sustainable drainage and rainwater harvesting for IIT Roorkee campus.*

WORK EXPERIENCE

Teaching Assistant 8/2023 – 12/2023
Purdue University *West Lafayette, IN*

- Course *CE 597: Data Science for Smart Cities*, instructed by Dr. Satish Ukkusuri
- Development and instruction of 6 introductory tutorial sessions for using Python for data analytics in Jupyter Lab in addition to other duties (office hours, grading, etc.).

Graduate Research Assistant 8/2019 – Present
Purdue University *West Lafayette, IN*

- Worked on a collection of projects to assess human mobility patterns at scale and their relation with inequitable distribution of accessibility to jobs, transit, and places of interest as well as environmental inequity. Projects sponsored by the National Science Foundation and Indiana Department of Transportation (DOT).
- Major outcomes/contributions include A-RESCUE 3.0, a hurricane evacuation micro traffic simulator, mobilkit, a Spark-based Python toolkit for processing high-volume passively collected smartphone GPS data, and Spatial Accessibility of America, a repository of spatial accessibility metrics developed for the 50 largest urban areas of the U.S.

Graduate Research Assistant 8/2017 – 7/2019
Michigan State University *East Lansing, MI*

- Assessed the performance and effectiveness of a pilot rear-facing collision avoidance system on snowplows. Project sponsored by the Michigan DOT.
- Analyzed the effects of the 2017 speed limit change in Michigan on operating speeds based on three data sources.
- Developed OMR recognition system to automate processing of the annual state-wise safety belt survey data.

Research Intern 5/2016 – 6/2016
Indian Institute of Science *Bengaluru, India*
Supervisor: Dr. Ashish Verma

- Worked on the project "Spatial Analysis of Pedestrian Crowds" of the main project "*The Kumbh Mela Experiment: Measuring and Understanding the Dynamics of Mankind's Largest Crowd*", Ujjain, India.
- Studied pedestrian traffic flow theory and the social force method to study the basic forms of interaction among pedestrian groups.

PUBLICATIONS & PRESENTATIONS

Articles in Peer Reviewed Journals

9. (**Under review**) What determines travel time and distance decay in spatial interaction and accessibility?
Verma, R., Ukkusuri, S.V.
Submitted to *Journal of Transport Geography*.

8. (**Under review**) Household Evacuation Decision Making During Simultaneous Disasters: Hurricane Ida and the COVID-19 Pandemic
Siebeneck, L., Lei, Z., Sharma, P., **Verma, R.**, Osazuwa-Peters, P., Ukkusuri, S.V.
Submitted to *International Journal of Disaster Risk Reduction*.

7. Comparison of home detection algorithms using smartphone GPS data.
Verma, R., Mittal, S., Lei, Z., Chen, X., Ukkusuri, S.V.
EPJ Data Science, 13(6) (**2024**). doi: 10.1140/epjds/s13688-023-00447-w

6. Crosswalk detection from satellite imagery for pedestrian network completion.
Verma, R., Ukkusuri, S. V.
Transportation Research Record, 0(0) (**2023**). doi: 10.1177/03611981231210545

5. A link criticality approach for pedestrian network design to promote walking.
Verma, R., Ukkusuri, S. V.
npj Urban Sustainability, 3(48) (**2023**). doi: 10.1038/s42949-023-00114-z

4. Progression of hurricane evacuation-related dynamic decision-making with information processing.
Verma, R., Shen, J., Benedict, B. C., Murray-Tuite, P., Lee, S., Ukkusuri, S. V.
Transportation Research Part D: Transport and Environment, 108, 103323 (**2021**).
doi: 10.1016/j.trd.2022.103323

3. Spatiotemporal contact density explains the disparity of COVID-19 spread in urban neighborhoods.
Verma, R., Yabe, T., Ukkusuri, S.V.

Scientific Reports, 11(10952) (**2021**). doi: 10.1038/s41598-021-90483-1

2. Comparison of support vector and non-linear regression models for estimating large-scale vehicular emissions, incorporating network-wide fundamental diagram for heterogeneous vehicles.
Saedi, R., **Verma, R.**, Zockaei, A., Ghamami, M., Gates, T.J.
Transportation Research Record, 2674(5), 70–84 (**2020**). doi: 10.1177/0361198120914304

1. Behavioral analysis of drivers following winter maintenance trucks enabled with collision avoidance system.
Verma, R., Saedi, R., Zockaie, A., Gates, T.J.
Transportation Research Record, 2673(10), 394-404 (**2019**). doi: 10.1177/0361198119850131

Articles in Conference Proceedings

2. How information heterogeneity influences traffic congestion during hurricane evacuation.
Verma, R., Lei, Z., Xue, J., Shen, J., Gehlot, H., Ukkusuri, S.V., Murray-Tuite, P.
2021 IEEE International Intelligent Transportation Systems Conference (ITSC), 1833-1838 (**2021**). doi: 10.1109/ITSC48978.2021.9564797

1. A framework for incorporating the network fundamental diagram into large-scale emission estimation.
Saedi, R., **Verma, R.**, Zockaei, A., Ghamami, M., Gates, T.J.
Journal of Transport & Health 9, S54-S55 (**2018**). doi: 10.1016/j.jth.2018.05.041

Articles in Preparation

3. Towards a generalized accessibility measure for transportation equity and efficiency.
Verma, R., Debnath, M., Mittal, S., Ukkusuri, S.V.
Economics ArXiv (**2024**). doi: arXiv:2404.04985

2. Understanding hurricane evacuation/return behaviors under compounding risks – Evidence from Hurricane Ida.
Lei, Z., **Verma, R.**, Siebeneck, L., Ukkusuri, S.V.

1. Long-term forecasts of statewide travel demand patterns using large-scale mobile phone GPS data: A case study of Indiana.
Verma, R., Ka, E., Ukkusuri, S.V.

Conference Presentations

9. Transportation equity assessment in Indiana: Recent findings.
Verma, R., Debnath, M.
110th Purdue Road School Conference and Expo, **2024** (presentation)

8. Comparison of home detection algorithms using smartphone GPS data.
Verma, R., Mittal, S., Lei, Z., Chen, X., Ukkusuri, S.V.
Transportation Research Board 103rd Annual Meeting, Washington D.C., **2024** (poster)

7. Leveraging large-scale cell phone geolocation data to inform high-resolution transportation planning in Indiana.
Verma, R., Ukkusuri, S.V.
109th Purdue Road School Conference and Expo, **2023** (poster)

6. Measuring Indiana's transportation equity using large-scale data.
Verma, R., Deodhar, S., Ukkusuri, S.V., Gkritza, N.
109th Purdue Road School Conference and Expo, **2023** (poster)

5. Crosswalk detection from satellite imagery for pedestrian network completion.
Verma, R., Ukkusuri, S.V.
Transportation Research Board 102nd Annual Meeting, Washington D.C., **2023** (presentation)

4. How hurricane evacuation dynamic decision-making progresses with information-seeking behavior.
Verma, R., Shen, J., Murray-Tuite, P., Lee, S., Ge, Y., Ukkusuri, S.V.
INFORMS: Mini-conference on 'Decision Making for Emerging Risks', **2021** (presentation) and *Transportation Research Board 100th Annual Meeting, Washington D.C.*, **2022** (poster)

3. An efficient calibration methodology of microsimulation model for signalized intersections under heterogeneous and indisciplined traffic environment.
Paul, M., **Verma, R.**, Ghosh, I.
Transportation Research Board 98th Annual Meeting, Washington D.C., **2019** (poster)

2. Behavioral analysis of drivers following winter maintenance trucks enabled with collision avoidance system.
Verma, R., Saedi, R., Zockaie, A., Gates, T.J.
Transportation Research Board 98th Annual Meeting, Washington D.C., **2019** (presentation)

1. Large-scale emission estimation framework by incorporating the network-wide fundamental diagram: Introduction to network-wide emission diagram.
Saedi, R., **Verma, R.**, Zockaie, A., Ghamami, M.
International Conference on Transportation & Health, Mackinac Island, MI, **2018** (poster)

RESEARCH PROJECTS

Official Reports

3. Forecasting shifts in Hoosiers' travel demand and behavior.
Verma, R., Luo, H., Deodhar, S., Ka, E., Chahine, R., Natu, P., Malhotra, H., Polisetty, V., Thakkar, D. J., Ukkusuri, S. V., Cai, H., Dunlop, S. R., Iyer, A. V., & Gkritza, K.
Joint Transportation Research Program, West Lafayette, Purdue University.
Publication No. FHWA/IN/JTRP-2023/28 (**2023**). doi: 10.5703/1288284317685

2. Hazards SEES: Bridging information, uncertainty, and decision-making in hurricanes using an interdisciplinary perspective.
Ukkusuri, S.V., Murray-Tuite, P., Lee, S., Ge, Y., Lei, Z., **Verma, R.**, Gehlot, H., Xue, J., Shen, J., Zhan, X., Qian, X., Le, T., et al.
National Science Foundation, Award #1520338 (Oct 7, **2021**).

1. Evaluation of a collision avoidance and mitigation system (CAMS) on winter maintenance trucks.
Zockaie, A., Saedi, R., Gates, T.J., Savolainen, P.T., Schneider, B., Ghamami, M., **Verma, R.**, Fakhrmoosavi, F., Kavianipour, M., Shojaie, M., Singh, H., Zhou, C.
Michigan Department of Transportation Research Administration, OR 17-103 (Sep 18, **2018**).

Ongoing projects

2. Addressing accessibility, equity, and environmental justice measures of infrastructure facilities in Indiana.
Joint Transportation Research Program project SPR 4711 with the Indiana Department of Transportation (INDOT) (approved **2022**).

1. RAPID proposal: Collaborative proposal: Examining household movements and decision-making

in a compounding risk event.
National Science Foundation, Award #2153919 and #2153913 (approved **2021**).

AWARDS & HONORS

Outstanding Service in Graduate Education 4/2024
College of Engineering, Purdue University ($2,000)

Eldon J. Yoder Memorial Award 9/2023
Transportation Area Grad Awards, Lyles School of Civil Engineering, Purdue University

Best ITE Student Chapter Award 8/2023
(Received as outgoing chapter president)
Great Lakes ITE District Annual Meeting, Grand Rapids, MI ($500)
ITE International and West District Annual Meeting, Portland, OR ($1,000)

News article by *The Washington Post* 2/2023
(For the paper *Crosswalk detection from satellite imagery for pedestrian network completion*)

Erin Flannigan Travel Award 11/2022
102nd Transportation Research Board Annual Meeting ($300)

M.S. Student of the Year 5/2019
Department of Civil Engineering, Michigan State University

Annual ITE Scholarship 2/2019
Institute of Transportation Engineers - Michigan Chapter ($3,000)

Student Travel Award 6/2018
2018 International Conference on Transport & Health ($800)

Best Poster in Civil Engineering (Transportation) 3/2018
2018 Engineering Graduate Research Symposium, Michigan State University

Merit-cum-Means Scholarship 1/2014 - 4/2015
Indian Institute of Technology Roorkee, INR 200,000 (≈$2,600) over 2 years

EXTRACURRICULAR COURSEWORK

Teaching and Learning in Engineering Graduate Certificate 5/2023
Certificate program at Purdue University's School of Engineering Education (ENE), including:

- ENE 506: Content, Assessment, and Pedagogy
- ENE 685: Engineering Education Methods
- ENE 687: Mentored Teaching in Engineering
- ENE 695: Succeeding as an Engineering Professor

Complete Guide to Tensorflow for Deep Learning with Python 5/2021
(Udemy)

Text Mining and Analytics 2/2020
University of Illinois, Urbana-Champaign (Coursera)

Introduction to Graph Theory 7/2018
University of California, San Diego (Coursera)

Bayesian Statistics 5/2018
University of California, Santa Cruz (Coursera)

MEMBERSHIPS AND SERVICE

Professional Organizations

- American Society of Civil Engineers 3/2018 – 3/2019
  (Student member)
- Institute of Transportation Engineers 12/2017 – Present
  (Served in Purdue Chapter as president (2022–23), vice-president (2021–22) & treasurer (2020–21))

Student Bodies

- Purdue Graduate Student Government, *Purdue University* 3/2020 – 4/2021
- Civil Engineering Graduate Student Advisory Council, *Purdue University* 9/2019 – Present
  (Served as vice-president during 2020–21)
- Graduate Employees Union, *Michigan State University* 11/2018 – 5/2019
  (Chair of the *Deferred Actions for Childhood Arrivals* (DACA) Committee)
- Civil Engineering Consortium, *I.I.T. Roorkee* 7/2016 – 12/2016
  (Graphic design lead)
- Information Management Group, *I.I.T. Roorkee* 2/2015 – 5/2017
  (Design and Creativity Head)

Volunteer Service

- Purdue's Algebra by 7th Grade 1/2023
  (Assisted high-performing students of color of 7th grade with math and English)
- Briarwood & RichField Tutoring & Life Skills Program 9/2021 – 12/2021
  (Tutored and assisted in homework kids of color in grades 1–4)
- National Service Scheme, *I.I.T. Roorkee* 8/2013 – 7/2014
  (Conducted several awareness activities as part of the *Environment* section)

SKILLS

Programming **Languages**: Python*, R*, SQL*, Bash*, Julia, Java, HTML/CSS/JS, MATLAB.

Tools: Jupyter*, LaTeX*, MySQL, Vim.

	Frameworks: (Py)Spark*, Dash/Plotly*, Pytorch, Tensorflow, jQuery.
Software	**Analysis**: Tableau*, QGIS*, ArcGIS*, Gephi, SPSS, VISSIM. **Design**: Figma*, Photoshop*, Illustrator*, AutoCAD.
Languages	English*, Hindi* (native), Spanish (basic).

* High proficiency.