

SUSHOBHAN SEN

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+1-(502)-641-2388 ◦ sen6@illinois.edusushobhansen.github.io ◦ linkedin.com/in/sushobhansen**RESEARCH INTERESTS**

- Study of cities with respect to infrastructure, environment, and people, and the relationship between them.
- Collection of in-situ properties of building materials and vegetation, and measurement of meteorological variables around them.
- Lab-scale testing of urban infrastructure.
- Numerical analysis of urban infrastructure.
- Study of the relationship between human behavior and the built-up environment.

EDUCATION

University of Illinois at Urbana-Champaign (UIUC)

Urbana, IL

Doctor of Philosophy in Civil Engineering

December, 2019 (expected)

Thesis Topic: Role of Pavements in Urban Energetics

*GPA: 4.0/4.0***University of Illinois at Urbana-Champaign (UIUC)**

Urbana, IL

Master of Science in Civil Engineering

August, 2015

Thesis Topic: Impact of Concrete Pavements on the Urban Heat Island

*GPA: 4.0/4.0***Indian Institute of Technology Roorkee**

Roorkee, India

Bachelor of Technology

May, 2013

Major: Civil Engineering

*GPA: 9.5/10.0**Institute Silver Medal***RESEARCH EXPERIENCE**

*University of Illinois at Urbana-Champaign***Role of Pavements in Urban Energetics**

August, 2015 - Present

Assessment of the local microclimatic impact of pavements on urban areas, with a focus on the Urban Heat Island (UHI) effect. I developed an aging albedo model for pavements and a pavement-urban canyon Computational Fluid Dynamics (CFD) model to study the local microclimate in Power Ranch, AZ. My work provides engineers and planners with quantitative tools to evaluate the benefits of interventions in improving local microclimate, livability, and public health.

Thermal and Optical Evaluation of Bonded Concrete Overlays on Asphalt Pavements

May, 2019 - Present

Thermal (including Coefficient of Thermal Expansion) and optical characterization of Bonded Concrete Overlays on Asphalt Pavement (BCOA) cores from around the US, bond strength between overlay and asphalt substrate, and characterization of base materials. Funded by the National Cooperative Highway Research Program (NCHRP).

Preservation Sustainability Assessment Tool

August, 2017 - August, 2018

Developed the Heat Island analysis component of the Preservation Sustainability Assessment Tool (PSAT) for the Federal Highway Administration (FHWA). Calculated the Global Warming Potential (GWP) of several pavement preservation techniques to quantify their heat island impact for all 50 states in the US, and integrated it into an Excel-based tool. Done in collaboration with researchers from the University of Illinois and Michigan State University.

Critical thinking in a Geometric Design class

January, 2018 - May, 2018

Conducted a study for a class on the Geometric Design of Roads to demonstrate how critical thinking could be developed by designing a class project around autonomous vehicles. Designed a class project where students would work in teams to develop new geometric design standards for autonomous vehicles and demonstrated the effectiveness of this method in developing critical thinking and meeting ABET accreditation requirements.

Impact of Concrete Pavements on Urban Heat Island

August, 2013 - August, 2015

Determination of the impact of pavement surface and sub-surface structure and materials on the Urban Heat Island. I developed a new method to measure the albedo of pavements in the field, and proposed one of the first aging albedo models for asphalt pavements. I developed a numerical pavement heat transfer model and devised new metrics to quantify the microscale impact of pavements on UHI.

*Technical University Munich, Germany***Image-Assisted Total Station**

May, 2012 - July, 2012

Integrated the subsystems of an Image-Assisted Total Station (IATS) and calibrated it using image processing algorithms and least squares fitting. Developed a C++ program to control the IATS subsystems and calibrate it through laboratory tests.

TEACHING EXPERIENCE*University of Illinois at Urbana-Champaign***CEE Transportation Instructional Fellow**

January - May, 2017 & 2019

Instructor of record for a class on the Geometric Design of Roads.

Graduate Mentor

August, 2015 - May, 2018

Mentored an undergraduate student through their sophomore, junior, and senior years through a variety of research projects. The student's work led to two poster presentations at international conferences, and a co-authored journal paper currently under review. Upon graduation, the student was accepted into a graduate program at a major research university.

Graduate Teaching Assistant

January - May, 2016 & 2018

TA for a class on the Geometric Design of Roads. Included in the campus-wide list of excellent TAs based on anonymous student feedback in 2018.

Graduate Teaching Assistant

August, 2018 - December, 2018

TA for an interdisciplinary course on teaching and leadership for graduate students across engineering departments.

Graduate Teaching Assistant

March, 2018 - April, 2018

TA for an interdisciplinary field course on infrastructure assessment and community service in Puerto Rico in the wake of Hurricane Maria.

Workshop Instructor

April & October, 2019

Led two workshops on each day for engineering students: Introductory Python for beginners, and Advanced Python for scientific applications.

WORK EXPERIENCE

*ePAVE, LLC***Technical Intern**

June, 2018 - August, 2018

Interned at ePAVE, LLC, a company developing a cool pavement solution to mitigate the urban heat island in Los Angeles, CA. Wrote an NSF SBIR Phase I proposal, a white paper on cool pavements, and a product manufacturing manual.

REPORTS AND PUBLICATIONS

Peer-Reviewed Journal Articles

- (J1) **Sen, S.**, Fernandéz, J.P.R.M., and Roesler, J. *Reflective Parking Lots for Microscale Urban Heat Island Mitigation. Under review*
- (J2) **Sen, S.**, and Roesler, J. *Enhancing Critical Thinking in a Geometric Design Class using Autonomous Vehicle Problem. Under revision*
- (J3) **Sen, S.**, and Roesler, J. *Wind direction and cool surface strategies on microscale urban heat island. Urban Climate, In Press*

- (J4) **Sen, S.**, Roesler, J., Ruddell, B., and Middel, A. (2019) *Cool pavement strategies for urban heat island mitigation in suburban Phoenix, Arizona*. Sustainability, Vol. 11, No. 16, 4452, doi: [10.3390/su11164452](https://doi.org/10.3390/su11164452)
- (J5) **Sen, S.**, and Roesler, J. (2019) *Thermal and optical characterization of asphalt field cores for microscale urban heat island analysis*. Construction and Building Materials, Vol. 217, pp. 600-611, doi: [10.1016/j.conbuildmat.2019.05.091](https://doi.org/10.1016/j.conbuildmat.2019.05.091)
- (J6) Baral, A., **Sen, S.**, and Roesler, J. (2018) *Use-phase assessment of photocatalytic cool pavements*. Journal of Cleaner Production, Vol. 190, pp. 722-728, doi: [10.1016/j.jclepro.2018.04.155](https://doi.org/10.1016/j.jclepro.2018.04.155)
- (J7) **Sen, S.**, Roesler, J., and King, D. (2019) *Albedo estimation of finite-sized concrete specimens*. Journal of Testing and Evaluation, Vol. 47, No. 2, pp. -, doi: [10.1520/JTE20170059](https://doi.org/10.1520/JTE20170059)
- (J8) **Sen, S.**, and Roesler, J. (2017) *Microscale heat island characterization of rigid pavements*. Transportation Research Record: Journal of the Transportation Research Board, No. 2639, pp. 73-83, doi: [10.3141/2639-10](https://doi.org/10.3141/2639-10)
- (J9) **Sen, S.**, and Roesler, J. (2016) *Aging albedo model for asphalt pavements*. Journal of Cleaner Production, Vol. 117, pp. 169-175, doi: [10.1016/j.jclepro.2016.01.019](https://doi.org/10.1016/j.jclepro.2016.01.019)
- (J10) **Sen, S.**, and Roesler, J. (2016) *Contextual heat island assessment for pavement preservation*. International Journal of Pavement Engineering, Vol. 19, No. 10, pp. 865-873, doi: [10.1080/10298436.2016.1213842](https://doi.org/10.1080/10298436.2016.1213842)

Peer-Reviewed Conference Papers

- (C1) **Sen, S.**, and Roesler, J. (2019) *Coupled pavement-urban canyon model for cool pavements assessment*. Airfield and Highway Pavements 2019: Innovation and Sustainability in Highway and Airfield Pavement Technology, Chicago, IL, USA, pp. 207-215, doi: [10.1061/9780784482476.022](https://doi.org/10.1061/9780784482476.022)
- (C2) Baral, A., **Sen, S.**, and Roesler, J. (2018) *Environmental design concept for multi-functional concrete overlays*. 9th International DUT-Workshop on Research and Innovations for Design of Sustainable and Durable Concrete Pavements, Potsdam, Germany
- (C3) **Sen, S.**, and Roesler, J. (2017) *Pavement geometry in microscale urban heat islands*. Conference of the Transportation Association of Canada, St. Johns, NL, Canada ([link](#))
- (C4) **Sen, S.**, Baral, A., and Roesler, J. (2017) *Use-phase sustainability through preservation*. 10th International Conference on Road and Airfield Pavement Technology, Hong Kong
- (C5) **Sen, S.**, and Roesler, J. (2017) *An uncoupled pavement-urban canyon model for heat islands*. International Symposium on Pavement Life Cycle Assessment, Champaign, IL, ISBN 978-1-315-15932-4, pp. 111-120, doi: [10.1201/9781315159324-13](https://doi.org/10.1201/9781315159324-13)
- (C6) **Sen, S.**, and Roesler, J. (2016) *Albedo as an engineering property of concrete pavements*. 11th International Conference on Concrete Pavements, San Antonio, TX, ISBN

978-0-9860291-2-7, pp. 59-71 (**awarded best paper by a young author**)

- (C7) King, D., Roesler, J., and **Sen, S.** (2016) *Emissions reducing benefits of multi-functional photocatalytic concrete inlays*. 11th International Conference on Concrete Pavements, San Antonio, TX, ISBN 978-0-9860291-2-7, pp. 72-81
- (C8) **Sen, S.**, King, D., and Roesler, J. (2015) *Structural and environmental benefits of concrete inlays for pavement preservation*. Airfield and Highway Pavements 2015, Miami, FL, pp. 697-707, doi: [10.1061/9780784479216.062](https://doi.org/10.1061/9780784479216.062)
- (C9) **Sen, S.**, and Roesler, J. (2014) *Assessment of concrete pavement structure on urban heat island*. International Symposium on Pavement Life Cycle Assessment, Davis, CA, pp. 191-200 ([link](#))

Theses

- (T1) **Sen, S.** (2015) *Impact of concrete pavements on the Urban Heat Island*. University of Illinois at Urbana-Champaign, Urbana, IL. Masters Thesis

Reports

- (R1) Zhou, Q., Okte, E., **Sen, S.**, Ozer, H., Al-Qadi, I. L., Roesler, J. R., and Chatti, K. (2019) *Development of a Life-cycle Assessment Tool for Pavement Preservation and Maintenance on Flexible and Rigid Pavement Vol I*. Illinois Center for Transportation Series No. ICT-19-010, Illinois Center for Transportation, UIUC, Rantoul, IL ([link](#))
- (R2) Zhou, Q., Okte, E., **Sen, S.**, Rajaei, S., Ozer, H., Al-Qadi, I. L., Roesler, J. R., and Chatti, K. (2019) *Development of a Life-cycle Assessment Tool for Pavement Preservation and Maintenance on Flexible and Rigid Pavement Vol II*. Illinois Center for Transportation Series No. ICT-19-011, Illinois Center for Transportation, UIUC, Rantoul, IL ([link](#))
- (R3) **Sen, S.**, and Moradian, K. (2018) *Better pavements make better communities: the promise of cool pavements*. White paper for ePAVE, LLC, Los Angeles, CA ([link](#))
- (R4) Fernández, J.P.R.M., Roesler, J., and **Sen, S.** (2015) *Determining the albedo of small cement mortar specimens using view factors*. Report for the Research Experiences for Undergraduates (REU) Program, University of Illinois at Urbana-Champaign, Urbana, IL
- (R5) Fernández, J.P.R.M., Roesler, J., and **Sen, S.** (2015) *Temporal and spatial distribution of albedo in UIUC parking lots*. Report for the Research Experiences for Undergraduates (REU) Program, University of Illinois at Urbana-Champaign, Urbana, IL

Proposals

- (P1) *Multi-Functional Concrete Inlays* (2014). Proposal to the University Transportation Center for Highway Pavement Preservation at Michigan State University. PI: Roesler, J.

- (P2) *Fatigue and Fracture of Fiber Reinforced Cementitious Bonded Overlay for Asphalt Pavement Preservation* (2015). Proposal to BASF GmbH. PI: Roesler, J.
- (P3) *SBIR Phase I: An Environmentally Sustainable Surface Treatment for Pavement Preservation: Research & Development Study* (2018). Proposal to the National Science Foundation. PI: Moradian, K.
- (P4) *Best Practice Guidelines for Cool Pavements* (2019). Proposal to RMC Research & Education Foundation. PI: Roesler, J.

PRESENTATIONS

Seminars

- (1) **Sen, S.** (2016) *Challenges in measuring pavement albedo*. The Kent Seminar Series, Advanced Transportation Research and Engineering Laboratory (ATREL), University of Illinois at Urbana-Champaign, October 6, 2016, Rantoul, IL
- (2) **Sen, S.** (2015) *Albedo for pavement engineers*. The Kent Seminar Series, Advanced Transportation Research and Engineering Laboratory (ATREL), University of Illinois at Urbana-Champaign, December 3, 2015, Rantoul, IL
- (3) **Sen, S.** (2014) *A bottom-up approach to urban heat islands: background and challenges*. The Kent Seminar Series, Advanced Transportation Research and Engineering Laboratory (ATREL), University of Illinois at Urbana-Champaign, October 23, 2014, Rantoul, IL

Conference Presentations

- (1) **Sen, S.** (2018) *Assessment of heat island impact from asphalt field cores*. 97th Annual Meeting of the Transportation Research Board, January 10, 2018, Washington, DC
- (2) **Sen, S.** (2017) *Pavement albedo distribution and its impact on microscale heat island characterization*. TRB Subcommittee AFD00(2) meeting, 96th Annual Meeting of the Transportation Research Board, January 9, 2017, Washington, DC
- (3) **Sen, S.** (2016) *Multi-functional concrete inlays for pavement preservation and sustainability*. International Concrete Sustainability Conference, May 15, 2016, Washington, DC
- (4) **Sen, S.** (2016) *Contextual life cycle assessment framework for pavement preservation*. TRB Subcommittee AFD00(2) meeting, 95th Annual Meeting of the Transportation Research Board, January 14, 2016, Washington, DC

Poster Presentations

- (1) **Sen, S.** (2018) *Cool pavements for mitigating the Urban Heat Island*. Sustainable Cities: The Institute for Sustainability, Energy, and Environment (ISEE) Congress, October 3, 2018, Urbana, IL

- (2) **Sen, S.** (2017) *Assessment of the urban microclimatic impact of pavements*. 6th International Transportation PhD Student Symposium, October 21, 2017, Urbana, IL (**awarded second prize for best poster and presentation**)
- (3) **Sen, S.** (2017) *Pavement albedo distribution and its impact on microscale heat island characterization*. 96th Annual Meeting of the Transportation Research Board, January 10, 2017, Washington, DC
- (4) **Sen, S.** (2017) *Analyzing the role of concrete pavements in urban energetics*. 11th International Conference on Concrete Pavements, August 28, 2016, San Antonio, TX
- (5) **Sen, S.** (2015) *Multi-functional concrete inlays*. Center for Highway Pavement Preservation Symposium, July 22, 2015, East Lansing, MI
- (6) **Sen, S.** (2015) *Impact of thermal inertia in pavements and the urban heat island*. 94th Annual Meeting of the Transportation Research Board, January 13, 2015, Washington, DC
- (7) **Sen, S.** (2014) *Assessment of concrete pavement structure on urban heat island*. International Symposium on Pavement Life Cycle Assessment, October 14, 2014, Davis, CA

HONORS AND AWARDS

Illinois Center for Transportation

PhD Student Symposium Award (2nd place) October, 2017
 Awarded second place for poster and presentation on *Assessment of the Urban Microclimatic Impact of Pavements* at the 6th International Transportation PhD Student Symposium, Urbana, IL.

International Society for Concrete Pavements

Bengt F. Friberg Award for Best Paper by a Young Author August, 2016
 Awarded for *Albedo as an Engineering Property of Concrete Pavements* at the 11th International Conference on Concrete Pavements, San Antonio, TX.

University of Illinois at Urbana-Champaign

Mavis Future Faculty Fellowship August, 2017 - July, 2018
 Fellowship in the College of Engineering to train top graduate students for a future career in academia.

CEE Transportation Instructional Fellowship January, 2017 & 2019
 Instructional fellowship to teach a class as the instructor-of-record.

Teacher Scholar Certificate May, 2018
Teaching certification from the Center for Innovation in Teaching and Learning (CITL).

Graduate Teacher Certificate May, 2018
Teaching certification from the Center for Innovation in Teaching and Learning (CITL).

Ranked as Excellent TA July, 2018
Ranked as 'Excellent TA' across the university based on anonymous student feedback for the Spring 2018 semester.

Ravindar K and Kavita Kinra Fellowship August, 2013 - July, 2014
Fellowship in the Department of Civil and Environmental Engineering to explore a new area of research.

Indian Institute of Technology Roorkee

Institute Silver Medal and Other Honors October, 2013
Institute Silver Medal and other honors for graduating with the highest GPA in the B.Tech (Civil Engineering) Class of 2013.

The OP Jindal Group, India

OP Jindal Engineering and Management Scholarship December, 2012
National scholarship for excellence in engineering education and community service.

German Academic Exchange Service (DAAD), Germany

WISE Scholarship May, 2012 - July, 2012
Working Internships in Science and Engineering (WISE) scholarship to pursue summer research at Technical University Munich.

National Council of Educational Research and Training (NCERT), India

NTSE Scholarship May 2007, - May, 2013
National Talent Search Exam (NTSE) Scholarship from the Government of India for high school and undergraduate studies.

LEADERSHIP AND SERVICE

International Society for Concrete Pavements

Webmaster and student member July, 2015 - Present
Assisted in the preparation of conference proceedings and flash drive for the 11th Interna-

tional Conference on Concrete Pavements, San Antonio, TX organized by ISCP. Regularly assist in the maintenance of the [ISCP website](#).

Peer Review

August, 2014 - Present

Provided peer-review for manuscripts submitted to the International Journal of Pavement Engineering, Solar Energy, Environmental Research Letters, Journal of Cleaner Production, Transportation Research Record, Measurement, and the International Journal for Heat and Mass Transfer.

*University of Illinois at Urbana-Champaign***ITE UIUC Student Chapter**

August, 2015 - August, 2017

Secretary of the Institute of Transportation Engineers (ITE) Student Chapter. Responsibilities included overhauling and regularly updating the [website](#), sending emails, maintaining the mailing list, and taking pictures at events.

IGSA at UIUC

August, 2013 - Present

Elected President of the Indian Graduate Students Association (IGSA) at UIUC from August, 2014 - August, 2015 and webmaster from August, 2015 - Present. Responsibilities included overhauling and regularly updating the [website](#), chairing board meetings, handling external relations, and supervising the organization of various events on campus.

ASCE T&DI UIUC Student Chapter

August, 2016 - August, 2017

Outreach Chair at the ASCE Transportation & Development Institute (T&DI) UIUC Student Chapter. Responsibilities included organizing a successful field trip to a local readymix concrete plant.

ACI UIUC Student Chapter

August, 2013 - Present

Student member of the American Concrete Institute (ACI) UIUC Student Chapter. Participate annually in the Chapter's Engineering Open House booth.

*Japan International Cooperation Agency***The Kizuna Project**

February 13-19, 2013

Participated in a two-week exchange program to visit and assess tsunami-affected areas in northeastern Japan, specifically the village of Minamisanriku. Presented findings and recommendations on behalf of my teammates to JICA and local representatives.

*Indian Institute of Technology Roorkee***The Literary Section**

July, 2012 - May, 2013

Additional Secretary in-charge of the English Debating Society. Responsibilities included

holding weekly debates, liaising with faculty adviser, the training new members, leading the university contingent at inter-university tournaments, and organizing IIT Roorkee's debating tournament, *Vox Populi*.

Kshitij: The Official Student Literary Magazine

August, 2011 - May, 2012

Executive Editor on the English Editorial Desk. Responsibilities included training new writers, editing submissions, writing literature, and assisting with typesetting.

COMPUTER SKILLS

Software

AASHTO Pavement ME, OpenFOAM, AutoCAD Civil 3D, ANSYS FLUENT, Mathematica, MATLAB, Git, OpenMP, MPI, Arduino, ArcGIS, QGIS

Languages

C/C++/C#, Python, Excel VBA, HTML/CSS/JS, L^AT_EX, Bash