

SUSHOBHAN SEN

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- Study of cities with respect to their 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 specific pieces of infrastructure.
- Wind Tunnel testing of reduced-scale urban prototypes.
- Computational Fluid Dynamics (CFD) and Machine Learning-based modeling of the urban environment.
- 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

May, 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

Doctoral dissertation on the assessment of the local microclimatic impact of pavements on urban areas for improved sustainability. I modified an aging albedo model into a form that could easily be calibrated at any location and developed a statistical model to predict the thermal and optical properties of asphalt and concrete. I developed a pavement-urban canyon Computational Fluid Dynamics (CFD) model and used it to study the local microclimate in Power Ranch, AZ. My work provided pavement engineers with tools to

evaluate the benefits of engineering interventions at a microscale to mitigate the impact of pavements on the surrounding environment in urban areas.

Preservation Sustainability Assessment Tool

August, 2017 - August, 2018

Developed the Heat Island analysis component of a Preservation Sustainability Assessment Tool for the Federal Highway Administration (FHWA). This involved applying methods from my previous research to quantify the heat island impact of pavement preservation solutions for all 50 states in the US, and integrating the results into an Excel-based tool. This was done in collaboration with researchers from the University of Illinois and Michigan State University.

Improving Metacognition in a Geometric Design Class

January, 2018 - May, 2018

Conducted a teaching effectiveness evaluation study for CEE 415 Geometric Design of Roads to demonstrate how metacognition could be improved by designing a class project around autonomous vehicles. Working in multi-disciplinary teams, students were required to develop new design criteria by critically analyzing existing ones and reading the latest literature, and then implement their new criteria in their projects. Collected data to demonstrate the effectiveness of this method in improving metacognition and meeting ABET accreditation requirements.

Impact of Concrete Pavements on Urban Heat Island

August, 2013 - August, 2015

Master's thesis on the determination of the impact of pavement surface and sub-surface structure and materials on the Urban Heat Island. During this research, I developed a new method to measure the albedo of pavements in the field, and developed 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. My thesis has been published in the form of three first-author, peer-reviewed conference publications and two first-author peer-reviewed journal articles, as well as several follow-on publications.

Technical University Munich, Germany

Image-Assisted Total Station

May, 2012 - July, 2012

Summer research internship on integrating the subsystems of an Image-Assisted Total Station (IATS) and calibrating it using image processing algorithms and least squares fitting. Included development of a C++ program to control the IATS subsystems and calibration from laboratory tests. The IATS and the calibration algorithm I developed can be used for rapid surveying and observation of natural and built-up environment.

TEACHING EXPERIENCE

University of Illinois at Urbana-Champaign

CEE Transportation Instructional Fellow

January, 2017 - May, 2017

Awarded a fellowship in the Department of Civil and Environmental Engineering to teach CEE 415 Geometric Design of Roads to a class of 55 graduate and undergraduate students. I developed an updated syllabus, designed a new semester project, and re-designed the course materials. In addition, I delivered lectures, made and graded homework, exams, and project reports, taught AutoCAD Civil 3D, and held regular office hours. Rated 4.1 out of 5 in anonymous student feedback.

Graduate Mentor

August, 2015 - May, 2018

Mentored an undergraduate student through their sophomore, junior, and senior years through a variety of research projects related to my own research. 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, 2018 - May, 2018

TA for CEE 415 Geometric Design of Roads, a class of 62 graduate and undergraduate students. Made and graded homework, exams, and project reports, while also holding regular office hours and teaching AutoCAD Civil 3D. Delivered lectures in the instructor's absence.

Graduate Teaching Assistant

March, 2018 - April, 2018

TA for ABE 498 Disaster Relief Projects: Hurricane Maria in the Department of Agriculture and Biological Engineering, a class of 37 undergraduate students ranging from freshmen to seniors from across departments. Supervised students on a week-long field survey in Puerto Rico to assess the state of the infrastructure six months after Hurricane Maria struck. Taught students how to assess infrastructure damage, develop sustainable and local solutions, and write professional reports for the local community to use.

Graduate Teaching Assistant

January, 2016 - May, 2016

TA for CEE 415 Geometric Design of Roads, a class of 68 graduate and undergraduate students. Made and graded homework, exams, and project reports, while also holding regular office hours and teaching AutoCAD Civil 3D. Delivered lectures in the instructor's absence. Rated 4.3 out of 5 in anonymous student feedback.

REPORTS AND PUBLICATIONS

Peer-Reviewed Journal Articles

- (J1) 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)
- (J2) **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)
- (J3) **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)
- (J4) **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)
- (J5) **Sen, S.**, and Roesler, J. (2016) *Contextual heat island assessment for pavement preservation*. International Journal of Pavement Engineering, *In Press*, doi: [10.1080/10298436.2016.1213842](https://doi.org/10.1080/10298436.2016.1213842)

Peer-Reviewed Conference Papers

- (C1) 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
- (C2) **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](#))
- (C3) **Sen, S.**, Baral, A., and Roesler, J. (2017) *Use-phase sustainability through preservation*. 10th International Conference on Road and Airfield Pavement Technology, Hong Kong
- (C4) **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)
- (C5) **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**)
- (C6) 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
- (C7) **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)

- (C8) **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) Mendéz-Ruiz, J.P., 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
- (R2) Mendéz-Ruiz, J.P., 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) Roesler, J., and **Sen, S.** (2014) *Multi-Functional Concrete Inlays* Proposal to the University Transportation Center for Highway Pavement Preservation at Michigan State University. PI: Roesler, J. Approved
- (P2) Roesler, J., and **Sen, S.** (2015) *Fatigue and Fracture of Fiber Reinforced Cementitious Bonded Overlay for Asphalt Pavement Preservation* Proposal to BASF GmbH. PI: Roesler, J. RFP withdrawn

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.** (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**)
- (2) **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
- (3) **Sen, S.** (2017) *Analyzing the role of concrete pavements in urban energetics*. 11th International Conference on Concrete Pavements, August 28, 2016, San Antonio, TX
- (4) **Sen, S.** (2015) *Multi-functional concrete inlays*. Center for Highway Pavement Preservation Symposium, July 22, 2015, East Lansing, MI
- (5) **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
- (6) **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 the paper on *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

Awarded a competitive fellowship in the College of Engineering to train top graduate students for a future career in academia. Participated in weekly workshops covering research, teaching, and service requirements and resources for faculty. Also mentored an undergraduate student on a project and completed a teaching effectiveness evaluation study for a course.

CEE Transportation Instructional Fellowship

January, 2017 - May, 2017

Awarded an instructional fellowship to teach CEE 415 Geometric Design of Roads in the Spring 2017 semester.

Teacher Scholar Certificate

May, 2018

Received the Center for Innovation in Teaching and Learning's (CITL) Teacher Scholar Certificate for three semesters of teaching experience, development of original teaching materials, providing discipline-based service, and completing a course on college teaching.

Graduate Teacher Certificate

May, 2018

Received CITL's Graduate Teacher Certificate for two semesters of teaching experience, collection and use of student feedback, and participation in teaching workshops.

Ravindar K and Kavita Kinra Fellowship

August, 2013 - July, 2014

Awarded a 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

Awarded the 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

Awarded a competitive national scholarship for excellence in engineering education and community service.

*German Academic Exchange Service (DAAD), Germany***WISE Scholarship**

May, 2012 - July, 2012

Awarded a competitive 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

Awarded a competitive 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 International 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, 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

Languages

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