Burhan Showkat

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Research Focus

My research links the **chemistry and rheology of asphalt binders to the field performance of pavement networks**, and works across the scales that connect them. At the *binder* scale, I quantify how modifiers such as polymers, crumb rubber, bio-oils, nano-materials, anti-stripping agents, and vitrimeric and self-healing systems, together with recycled content from RAP and construction and demolition waste, govern viscoelastic response, adhesion, and ageing. At the *mixture* scale, I trace those effects into the moisture damage, rutting, fatigue, and permeability of hot, cold, and recycled mixes subjected to realistic stress and conditioning histories. At the *network* scale, I turn that evidence into decisions through **mechanistic modelling, statistical and reliability analysis, machine learning, life cycle assessment and cost analysis, and optimisation**, yielding calibrated thresholds and decision-support tools that agencies and industry can deploy directly.

Underpinning all three is a **core of experimental capability**: independent operation, calibration, and protocol design across binder rheology, adhesion, and mixture performance testing, so that every model is anchored in measured behaviour.

Academic Qualifications

Indian Institute of Technology (IIT) Bombay **2017–2023**
Ph.D. in Civil Engineering (Transportation Engineering) • *CGPA 10.00/10.00* Mumbai, Maharashtra, India
Dissertation: Evaluating the Effect of Dynamic Stress on Moisture Damage Susceptibility of Asphalt Mixes Containing Reclaimed Asphalt Pavement (RAP).
Advisor: Prof. Dharamveer Singh

National Institute of Technology Karnataka (NITK) Surathkal **2015–2017**
M.Tech. in Civil Engineering (Transportation Engineering) • *CGPA 8.03/10.00* Mangalore, Karnataka, India
Thesis: A Study of Rheological and Creep Recovery Properties of Asphalt Binder Modified with Waste Toner.
Advisor: Prof. S. N. Suresha

Bangalore Institute of Technology **2008–2012**
B.E. in Civil Engineering • *85.23 %* Bengaluru, Karnataka, India

Professional Appointments

Institutional rankings cited are from the *QS World University Rankings by Subject 2026*, Civil & Structural Engineering.

Research Appointments

Virginia Polytechnic Institute and State University (Virginia Tech) **Jan. 2026–Present**
Postdoctoral Fellow, Via Dept. of Civil & Environmental Engineering • *VTTI* Blacksburg, Virginia, USA
QS Civil & Structural Engineering: 51–100
Reflective-crack propagation modelling of pavement interlayers; mechanics-based resilience assessment of flexible pavements under flood hazards.

King Fahd University of Petroleum and Minerals (KFUPM) **Sep. 2024–Jan. 2026**
Postdoctoral Fellow, Department of Civil and Environmental Engineering Dhahran, Saudi Arabia
QS Civil & Structural Engineering: 51–100
Bio-based and self-healing asphalt binders; machine-learning characterisation of recycled-aggregate asphalt; spatial optimisation for pavement asset management.

Indian Institute of Technology (IIT) Bombay **Mar.–Aug. 2023**
Project Research Scientist, Department of Civil Engineering Mumbai, Maharashtra, India
QS Civil & Structural Engineering: =42
Led agency-sponsored forensic investigation and quality-assurance programmes for flexible and rigid pavement networks.

Indian Institute of Technology (IIT) Bombay **May–Nov. 2022**
Research Associate, Department of Civil Engineering Mumbai, Maharashtra, India
QS Civil & Structural Engineering: =42

Industry Experience

Central Institute of Road Transport (CIRT) **Jul. 2016**
Summer Intern Pune, Maharashtra, India

Larsen & Toubro Ltd. (Delhi Cluster) **2012–2014**
Senior Planning Engineer Punjab, India
Planning, scheduling, and quality control for highway construction packages.

Research Themes

Moisture-Induced Damage and Durability of Asphalt Systems: Quantifies how coupled dynamic pore-pressure and traffic stress degrade the asphalt–aggregate bond. Introduced survival-analysis and atrophy-based formulations (Kaplan–Meier, Cox proportional hazards) that express moisture susceptibility as a probabilistic loss of structural capacity rather than a single-point strength ratio.

Materials Characterisation — Rheology and Chemistry of Asphalt Binders: Links binder chemistry and microstructure to viscoelastic response using DSR, BBR, FTIR, bond-strength, and contact-angle methods. Work spans polymer-, crumb-rubber-, bio-oil-, nano-material-, and anti-strip-modified binders, and establishes source-dependency effects within a single performance grade.

Recycling and Circular Materials in Pavement Construction: Evaluates the mechanical and durability consequences of reclaimed asphalt pavement (RAP), construction and demolition waste, and industrial by-products in hot and cold mixes. Addresses binder blending efficiency, blending-chart validity, and realistic limits on recycled content.

Resilience of Road Infrastructure to Climate Hazards: Develops mechanics-based frameworks that make pavement resilience computable, translating flood inundation and saturation histories into quantified losses of structural capacity and recovery time for flexible pavements.

Life Cycle Assessment (LCA) of Road Infrastructure: Assesses the cradle-to-grave environmental burden of pavement design, construction, and rehabilitation alternatives, coupling LCA outcomes with mechanistic performance so that sustainability gains are credited only where service life is preserved.

Data-Driven Pavement Management and Machine Learning: Applies multivariate statistics (PCA, PLS, MLR), copula-based joint-exceedance modelling, and supervised learning to pavement condition and materials datasets, producing screening thresholds and spatial optimisation strategies for maintenance prioritisation.

Structural Evaluation and Forensic Investigation of Pavements: Uses deflection-bowl analysis, back-calculation, and field-forensic protocols to diagnose root causes of distress in flexible and rigid pavements, and to calibrate network-level screening criteria for heavily overlaid sections.

Journal Publications

Listed most recent first. Impact Factor (IF) values reflect the latest Journal Citation Reports available at the time of preparation.

1. Tedla, T. A., Singh, D., & **Showkat, B.** (2024). Evaluating and modelling the evolutive behaviour of physical and mechanical properties of cold mix containing RAP. *International Journal of Pavement Research and Technology*, 17(6), 1419–1434. [Springer Nature; IF 3.5]
   doi:10.1007/s42947-023-00310-1

2. Tedla, T. A., Singh, D., & **Showkat, B.** (2023). Effects of air voids on comprehensive laboratory performance of cold mix containing recycled asphalt pavement. *Construction and Building Materials*, 368, 130416. [Elsevier; IF 8.9]
doi:10.1016/j.conbuildmat.2023.130416

3. **Showkat, B.**, & Singh, D. (2022). Comparing different HWTT analysis methods for asphalt mixes containing RAP and correlating with MIST–TSR. *Advances in Civil Engineering Materials*, 11(1), 410–437. [ASTM International; IF 1.4]
doi:10.1520/ACEM20220036

4. **Showkat, B.**, & Singh, D. (2022). Contribution of MIST conditioning in evolution of structural parameters of asphalt mixes containing recycled asphalt pavement. *Road Materials and Pavement Design*, 23(6), 1239–1265. [Taylor & Francis; IF 3.6]
doi:10.1080/14680629.2021.1883468

5. **Showkat, B.**, & Singh, D. (2022). Effect of MIST conditioning on the air voids and permeability of hot asphalt mixes containing reclaimed asphalt pavement. *Road Materials and Pavement Design*, 23(7), 1605–1632. [Taylor & Francis; IF 3.6]
doi:10.1080/14680629.2021.1910549

6. **Showkat, B.**, & Singh, D. (2022). Perceiving moisture damage of asphalt mixes containing RAP using survival analysis based on Kaplan–Meier estimator and Cox proportional hazards model. *Construction and Building Materials*, 320, 126249. [Elsevier; IF 8.9]
doi:10.1016/j.conbuildmat.2021.126249

7. **Showkat, B.**, & Singh, D. (2022). Using survival and atrophy to understand the effect of RAP on moisture-induced damage susceptibility of asphalt mixes. *International Journal of Pavement Engineering*, 23(14), 4857–4876. [Taylor & Francis; IF 3.7]
doi:10.1080/10298436.2021.1984474

8. Magar, S., Xiao, F., Singh, D., & **Showkat, B.** (2022). Applications of reclaimed asphalt pavement in India — A review. *Journal of Cleaner Production*, 335, 130221. [Elsevier; IF 10.7]
doi:10.1016/j.jclepro.2021.130221

9. Roopashree, M. S., Singh, D., & **Showkat, B.** (2022). Influence of same-grade asphalt binder from different sources and aging on moisture damage characteristics of asphalt–aggregate system. *Journal of Materials in Civil Engineering*, 34(8), 04022172. [ASCE; IF 3.2]
doi:10.1061/(ASCE)MT.1943-5533.0004308

10. Singh, D., **Showkat, B.**, & Girimath, S. (2022). Experimental, analytical, and analogical study of the effect of RAP extracted binder on rheology of polymer modified binder. *Road Materials and Pavement Design*, 23(5), 1011–1036. [Taylor & Francis; IF 3.6]
doi:10.1080/14680629.2020.1868552

11. **Showkat, B.**, & Singh, D. (2021). Effect of MIST conditioning on moisture-induced damage of RAP mixes using elastic moduli and stress–strain behavior. *Journal of Materials in Civil Engineering*, 33(12), 04021351. [ASCE; IF 3.2]
doi:10.1061/(ASCE)MT.1943-5533.0003988

12. Girimath, S., Singh, D., & **Showkat, B.** (2021). Influence of bio-oil modification on moisture-induced damage potential of asphalt binder and mix. *Advances in Civil Engineering Materials*, 10(1), 276–299. [ASTM International; IF 1.4]
doi:10.1520/ACEM20200143

13. **Showkat, B.**, Suresha, S. N., & Akhandappagol, N. (2020). Study of rheological and creep recovery properties of asphalt binder modified with waste toner. *Journal of Materials in Civil Engineering*, 32(11), 04020331. [ASCE; IF 3.2]
doi:10.1061/(ASCE)MT.1943-5533.0003411

14. Roopashree, M. S., Singh, D., & **Showkat, B.** (2020). A comprehensive study on source dependency of conventional, chemical and rheological properties of asphalt binder. *Construction and Building Materials*, 258, 120338. [Elsevier; IF 8.9]
doi:10.1016/j.conbuildmat.2020.120338

15. Singh, D., Kuity, A., Girimath, S., Suchismita, A., & **Showkat, B.** (2020). Investigation of chemical, microstructural, and rheological perspective of asphalt binder modified with graphene oxide. *Journal of Materials in Civil Engineering*, 32(11), 04020323. [ASCE; IF 3.2]
doi:10.1061/(ASCE)MT.1943-5533.0003385

16. Singh, D., **Showkat, B.**, & Girimath, S. (2020). Effect of recycled asphalt pavement binder on rheology of crumb rubber–modified binder — An experimental, analytical, and analogical study. *Advances in Civil Engineering Materials*, 9(1), 643–665. [ASTM International; IF 1.4]
doi:10.1520/ACEM20200077

17. Singh, D., **Showkat, B.**, & Rajan, B. (2020). Effects of amine and silane antistripping agents on rheological behavior of crumb rubber modified binder at high and low temperature. *Advances in Civil Engineering Materials*, 9(1), 387–410. [ASTM International; IF 1.4]
doi:10.1520/ACEM20190226

18. Singh, D., **Showkat, B.**, Rajan, B., & Shah, A. (2020). Rheological interference of amine and silane–based antistripping agents on crumb rubber–modified binder. *Journal of Materials in Civil Engineering*, 32(2), 04019347. [ASCE; IF 3.2]
doi:10.1061/(ASCE)MT.1943-5533.0003004

19. Singh, D., Yenare, C., & **Showkat, B.** (2020). Rheological and chemical characteristics of asphalt binder modified with groundnut shell bio-oil. *Advances in Civil Engineering Materials*, 9(1), 311–339. [ASTM International; IF 1.4]
doi:10.1520/ACEM20190227

20. Singh, D., **Showkat, B.**, & Sawant, D. (2019). A study to compare virgin and target asphalt binder obtained from various RAP blending charts. *Construction and Building Materials*, 224, 109–123. [Elsevier; IF 8.9]
doi:10.1016/j.conbuildmat.2019.07.038

Manuscripts Under Review

21. **Showkat, B.**, Rafiq, W., Abdulrahman, S., Babalghaith, A. M., Alqahtani, F. F., Rahman, S. M., & Al-Osta, M. Cross-modality laboratory and machine learning assessment of stone mastic asphalt with construction and demolition waste. *International Journal of Pavement Research and Technology* [Springer Nature; IF 3.5] — under review.

22. **Showkat, B.**, Baig, M. G., Alqahtani, F. F., Mishra, D., Al-Osta, M., & Abdulrahman, S. Multidimensional pothole management via copula-based joint exceedance and span-constrained seed-and-bundle spatial optimization. *International Journal of Pavement Engineering* [Taylor & Francis; IF 3.7] — under review.

23. **Showkat, B.**, & Singh, D. Thickness-aware deflection-bowl benchmarks for network screening of heavily overlaid asphalt pavements: Calibrated thresholds, forensic validation, and deployable software. *International Journal of Pavement Engineering* [Taylor & Francis; IF 3.7] — under review.

Manuscripts Under Internal Review

24. **Showkat, B.**, Joti, S. H., Amarh, E., Flintsch, G., & Mishra, D. Proxy-Based Annual Flood Hazard Functions for Pavement Resilience Assessment in Virginia. Completed manuscript — under internal review by postdoctoral supervisor.

25. **Showkat, B.**, Gavadakatla, V., Singh, D., & Gham, T. S. Analytical Stress Solution and Mechanical Interpretation of the Marshall-RT Test. Completed manuscript — under internal review.

Manuscripts in Preparation

26. **Showkat, B.**, Joti, S. H., Amarh, E., Flintsch, G., & Mishra, D. A Mechanics-Based Framework for Pavement Resilience Assessment with an Application to Flooding.

27. **Showkat, B.**, & Singh, D. A multivariate statistical framework (Pearson correlation, principal component analysis, multiple linear regression, and partial least squares) for asphalt mixes containing RAP subjected to varying stress cycles of MIST.
28. **Showkat, B.**, & Singh, D. Rayleigh-distribution modelling of the stress–strain response of asphalt mixes for the assessment of survival and atrophy.

Conference Papers and Abstracts

1. **Showkat, B.**, Joti, S. H., Amarh, E., Mishra, D., & Flintsch, G. Toward quantitative assessment of flood-related pavement resilience: Initial framework development and a representative case study for DOT asset management. *106th Transportation Research Board (TRB) Annual Meeting*, Washington, D.C., USA, January 2027 — accepted; under consideration for publication in *Transportation Research Record* (TRR).
2. **Showkat, B.**, Amarh, E., Flintsch, G., & Mishra, D. Annual Flood Hazard Models for Pavement Resilience Planning: A Virginia Case Study. *PIARC XXVIII World Road Congress*, Vancouver, Canada, 4–8 October 2027 — under review.

Collaborative Research Projects

Each entry states the research theme and the nature of my contribution.

1. **Self-Healing Asphalt via Microencapsulated Rejuvenators** 2025–2026
   KFUPM, Saudi Arabia. Microcapsule synthesis and characterisation; design of the healing-efficiency test matrix and interpretation of recovery response.
2. **Vitrimeric Bio-Modification of Asphalt Binder (Sulfur–Limonene Network)** 2025–2026
   KFUPM, Saudi Arabia. Rheological and chemical characterisation of the modified binder; linking network dynamics to high- and intermediate-temperature performance.
3. **Copula-Based Pothole Management and Spatial Optimisation** 2025–2026
   KFUPM, Saudi Arabia. Formulated the joint-exceedance severity criterion and the seed-and-bundle repair-clustering algorithm; led model development and validation.
4. **Review of Reclaimed Asphalt Pavement Practice in India** 2022
   IIT Bombay, India, with Tongji University, China. Synthesised national specifications, field practice, and performance evidence to define barriers to higher RAP adoption.
5. **Performance and Evolutive Modelling of Cold Mixes Containing RAP** 2021–2022
   IIT Bombay, India. Experimental design for air-void and curing-time effects; developed the time-dependent models describing evolution of physical and mechanical properties.
6. **Rheology of RAP-Blended Polymer- and Crumb-Rubber-Modified Binders** 2020–2022
   IIT Bombay, India. Experimental, analytical, and analogical (mechanical-analogue) modelling of blended-binder rheology.
7. **Source Dependency of Asphalt Binder Properties and Its Effect on Mix Performance** 2019–2022
   IIT Bombay, India. Conventional, chemical, and rheological testing across binder sources of identical grade; statistical attribution of performance variability to source and ageing.
8. **Bio-Oil Modification and Moisture Damage Resistance of Binders and Mixes** 2021
   IIT Bombay, India. Bond-strength and surface-energy characterisation; mix-scale verification of moisture-damage resistance.
9. **Graphene-Oxide Nano-Modification of Asphalt Binder** 2020
   IIT Bombay, India. Chemical, microstructural, and rheological characterisation of the nano-modified binder system.
10. **Anti-Stripping Agent Interference in Unmodified and Modified Binders** 2019–2020
    IIT Bombay, India. Isolated the rheological and chemical interference of amine- and silane-based agents in VG30, CRMB60, and PMB40 binders across the temperature spectrum.
11. **Groundnut-Shell Bio-Oil as a Sustainable Binder Modifier** 2019–2020
    IIT Bombay, India. Rheological and chemical assessment of bio-oil dosage effects.

12. **Degree of Binder Blending in RAP Mixes** 2019
IIT Bombay, India. Developed and trialled a novel experimental method for quantifying the extent of virgin–RAP binder blending.

13. **Validity of Linear Blending Charts for RAP Mix Design** 2018–2019
IIT Bombay, India. Tested blending-chart assumptions against absolute viscosity, performance grade, LAS, and MSCR criteria; identified where linearity fails.

Sponsored and Industry Projects

Agency- and industry-funded projects executed under the Principal Investigator.

Performance Evaluation

1. **Development of a Crack Propagation Tool to Assess the Efficacy of Interlayers in Mitigating Reflective Cracking.** 2026–Present, Virginia, USA. *Sponsor:* IFI Interlayer. *Role:* Lead Researcher.
2. **Use of Petcoke for Improving the Field Performance of Asphalt Binder.** 2025, Dammam, Saudi Arabia. *Sponsor:* Saudi Aramco. *Role:* Key Personnel.
3. **Confidential Project on Asphalt Binders and Mixes (NDA).** 2022, Maharashtra, India. *Sponsor:* Industry partner, USA. *Role:* Lead Researcher.
4. **Widening of Two/Four Lane with Paved Shoulder, Bidar to Humnabad Section of NH-50 (Km 54.370–101.400), Package II (EPC).** 2018, Karnataka, India. *Sponsor:* IL&FS Engineering and Construction Company Ltd. *Role:* Key Personnel.

Forensic Investigation

5. **Forensic Investigation of Distress on NH-16, Gundugolanu–Siddhantham (Km 950.542–1022.494) and Diwancheruvu–Siddhantham (Km 901.500–950.542).** 2022–2023, Andhra Pradesh, India. *Sponsor:* Safeway Concessions. *Role:* Lead Researcher.
6. **Forensic Investigation of Rigid Pavement Distresses, Kagvadar–Una Section of NH-8E (Km 139.915–180.478), Package IV.** 2022, Gujarat, India. *Sponsor:* National Highways Authority of India (NHAI). *Role:* Lead Researcher.
7. **Forensic Investigation of 34 Asphalt and Concrete Pavements in Mumbai to Determine Root Causes of Failure.** 2017–2018, Maharashtra, India. *Sponsor:* Special Investigation Team, Colaba. *Role:* Key Personnel.

Quality Assurance and Quality Control

8. **Quality Check of Micro-Surfacing Type-III, Eastern Express Highway, Sion (Km 584.750) to Golden Dyes Junction (Km 561.200).** 2023, Maharashtra, India. *Sponsor:* Mumbai Metropolitan Region Development Authority (MMRDA). *Role:* Key Personnel.
9. **Third-Party Inspection of Concrete Roads under Aurangabad Smart City Development Corporation Ltd.** 2023, Maharashtra, India. *Sponsor:* ASCDCL. *Role:* Lead Researcher.
10. **Quality Check of Cement Concrete Roads, T.T.C. Area, Mukand Company to Mahape–Shil (Km 0.000–3.042).** 2019, Maharashtra, India. *Sponsor:* Navi Mumbai Municipal Corporation (NMMC). *Role:* Key Personnel.
11. **Inspection of Flexible Pavement, Panvel to Indapur Section of NH-66 (Km 64+300–84+600).** 2018–2019, Maharashtra, India. *Sponsor:* National Highways Authority of India (NHAI). *Role:* Key Personnel.
12. **Quality Check of Cement Concrete Roads in KBMC Area under Maharashtra Suvarna Jayanti Nagarotthan Maha Abhiyan.** 2017–2018, Maharashtra, India. *Sponsor:* Kulgaon-Badlapur Municipal Corporation (KBMC). *Role:* Key Personnel.

Teaching

Courses Prepared to Teach — Undergraduate

- Transportation Engineering I and II (highway planning, geometric design, traffic engineering)
- Highway and Pavement Materials
- Civil Engineering Materials

- Pavement Design (flexible and rigid)
- Transportation and Materials Engineering Laboratory
- Engineering Statistics and Probability for Civil Engineers

Courses Prepared to Teach — Graduate

- Advanced Pavement Materials and Bituminous Binder Rheology
- Pavement Analysis and Design
- Pavement Evaluation, Maintenance, and Rehabilitation
- Pavement Management Systems
- Experimental Design and Statistical Methods in Materials Research

Proposed New Courses

- **Resilient and Sustainable Pavement Infrastructure** (senior UG / graduate elective). Integrates life cycle assessment, climate-hazard exposure, and mechanistic resilience so that students can evaluate a design on environmental burden and hazard performance together, rather than on structural capacity alone.
- **Data-Driven Methods for Infrastructure Materials** (graduate). Hands-on treatment of multivariate statistics, survival analysis, and machine learning applied to real materials and pavement-condition datasets, taught in Python and R with an emphasis on model interpretability for engineering decisions.
- **Circular Materials in Civil Infrastructure** (senior UG / graduate elective). Covers reclaimed asphalt pavement, construction and demolition waste, recycled aggregates, and bio-based modifiers — from characterisation and mix design through specification and field implementation.

Mentoring

- Mentoring 3 graduate students of diverse international backgrounds at Virginia Tech, USA (2026–Present).
- Mentored 6 interns from various IITs and NITs during summer research internships at IIT Bombay, India.
- Mentored 2 undergraduate students at IIT Bombay, India, through their B.Tech. term projects.

Experimental Expertise

Independent operator of the instrumentation below, including calibration and specimen fabrication. Governing standards are cited where a method is standardised.

- **Binder Rheology and Performance Grading:** Dynamic Shear Rheometer (AASHTO T 315) and Bending Beam Rheometer (T 313) for performance grading; Multiple Stress Creep and Recovery (T 350) and Linear Amplitude Sweep (T 391) for rutting and fatigue response; force ductility (T 300) and elastic recovery (T 301). Frequency–temperature sweeps, master-curve construction, and mechanical-analogue modelling.
- **Binder Adhesion, Surface Chemistry, and Composition:** Bitumen Bond Strength (AASHTO T 361) for asphalt–aggregate adhesion; dynamic contact angle and drop-shape analysis for surface free energy and work of adhesion (non-standardised research methodology); asphaltene fractionation (ASTM D6560 / IP 143).
- **Binder Consistency, Ageing, and Purity:** Vacuum-capillary (AASHTO T 202) and kinematic viscometry (T 201), penetration (T 49), softening point (T 53), and ductility (T 51); short- and long-term ageing by Rolling Thin Film Oven (T 240) and Pressure Aging Vessel (R 28); solubility (T 44), flash and fire point (T 48), and specific gravity (T 228).
- **Mixture Performance and Moisture Damage:** Superpave gyratory compaction (AASHTO T 312), Hamburg wheel tracking (T 324), indirect tensile strength (ASTM D6931), and falling-head permeability (non-standardised). Moisture conditioning by hydrostatic pore pressure (ASTM D7870) and freeze–thaw cycling, assessed against retained tensile strength (AASHTO T 283).
- **Binder Recovery and Mixture Composition:** Centrifuge extraction (ASTM D2172), ignition-oven binder content (ASTM D6307), and rotary-evaporator recovery (ASTM D5404), applied to quantify RAP binder availability and recovered-binder properties.

- **Aggregate Characterisation:** Superpave consensus properties (coarse and fine aggregate angularity, flat and elongated particles, sand equivalent) and source properties (Los Angeles abrasion, sulfate soundness, deleterious material) (AASHTO M 323).
- **Field and Non-Destructive Evaluation:** Falling Weight Deflectometer (ASTM D4694) with deflection-bowl analysis and layer-modulus back-calculation; Dynamic Cone Penetrometer (ASTM D6951); British Pendulum skid resistance (AASHTO T 278); MERLIN roughness survey.
- **Protocol Development:** Design of non-standard procedures where established methods do not isolate the mechanism of interest: a dynamic-stress moisture-conditioning regime relating pore-pressure cycles to field-representative loading; a laboratory method for quantifying the degree of virgin–RAP binder blending; and custom rheometer measurement templates authored in Anton Paar RheoCompass (time sweeps and parameterised protocols for non-standard loading and thermal histories).

Computational Skills

- **Programming and Statistical Computing:** Python, R, MATLAB, Spyder.
- **Pavement Design and Analysis:** IITPAVE, IITRIGID, KENPAVE, KGPBACK (FWD back-calculation), LCA Pave.
- **Data Analysis and Visualisation:** OriginPro, Tableau, Power BI.
- **Technical Drawing and Typesetting:** Inkscape, Marvin (chemical structures), LaTeX.

Tools Developed for Industry Adoption

- Deflection Bowl Parameter Calculator — network-level structural screening of asphalt pavements from FWD data.
- Pothole Management Tool — severity classification and spatially optimised repair bundling.

Professional Service

International Journal Reviewer

- *Construction and Building Materials* — Elsevier
- *Journal of Transportation Engineering, Part B: Pavements* — ASCE
- *International Journal of Pavement Research and Technology* — Springer Nature
- *Innovative Infrastructure Solutions* — Springer Nature
- *Environmental Science and Pollution Research* — Springer Nature

International and National Conference Reviewer

- 106th Transportation Research Board (TRB) Annual Meeting, 2027 — International
- 15th World Conference on Transport Research (WCTR) — International
- 4th, 5th, and 6th Conference of the Transportation Research Group of India (CTRG) — International
- 12th, 13th, and 14th Conference on Transportation Planning and Implementation Methodologies for Developing Countries (TPMDC) — International
- Recent Advances in Civil Engineering Materials (RAID) 2024, Conference on Solutions to Infrastructural Problems — National

Continuing Professional Development

Continuing Education Programmes and Workshops

- Stone Matrix Asphalt: Theory to Practice, IIT Bombay, India, 2023.
- 1st Indo-German Exchange on Roads and Pavements (IGERP), India / Germany, 2022.
- Characterisation of Asphalt Binder/Bitumen, IIT Bombay, India, 2022.
- The New IS 15462 Specifications on PMBs and Sustainable Roads with RAP and Rejuvenators, India, 2021.
- Characterisation of Materials and Design of Flexible Pavements, India, 2019.
- IRC 37:2018 Guidelines for Design of Flexible Pavements, India, 2019.
- Analysis and Design of Pavements and Highway Geometry, India, 2018.

- Workshop on Binder Rheology, NIT Tiruchirappalli, India, 2016.

Invited Participation and Webinars

- Toward the Next Generation of Flexible Pavement Materials: Bio-Based and Self-Healing Asphalt Concrete — R. Hajj, University of Illinois Urbana-Champaign, USA, 2026.
- Francis C. Turner Webinar on Smart, Sustainable, Durable, and Resilient Transportation Infrastructure Systems — H. Ceylan, ASCE, USA, 2026.
- Effect of Toolpath Strategies on Anisotropy and Structural Performance of 3D-Printed Concrete Gyroid Walls — S. Nair, Cornell University, USA, 2026.
- Stone Matrix Asphalt Brainstorming Session, India, 2022.
- **Speaker** — Overview of Materials, Design, and Construction Practices for Bituminous Pavements in India, in collaboration with Mansoura University, Egypt (Azadi Ka Amrit Mahotsav), 2021.
- Sensors and Technology for Pavers and Rollers, Mobile Automation (MOBA), 2021.
- Paving, Rolling, Compaction, and Milling Practices for Road Work — A. Balachandran, Caterpillar, 2020.

References

References available upon request.