

# Mohamed Badhrudeen Mohamed Rawoof

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## EDUCATION

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### University of Illinois Chicago (UIC)

Aug. 2017 - May 2022

*PhD, Civil Engineering*

*Chicago, IL*

- 4.0/4.0 GPA; Dissertation title: “Urban Intelligence: Tools and Models for Smart Cities” under the supervision of Dr. Sybil Derrile.
- **Relevant Courses:** Causal Inference and Learning, Transportation System Analysis, Urban Travel Forecasting, Advanced Transportation Demand Analysis, GIS for Planners, Cities and Sustainability, Transportation Project Appraisal, Introduction to Data Science.

### National Institute of Technology Karnataka

Sep. 2011 - July 2013

*MTech, Transportation Engineering*

*Mangalore, India*

- 7.94/10.0 CGPA; Thesis title: “Travel Time Estimation and Prediction using Data Fusion.”

### Government College of Engineering Salem

Aug. 2007 - May 2011

*BE, Civil Engineering*

*Salem, India*

- 8.66/10.0 CGPA; Graduated with distinction.

## RESEARCH EXPERIENCE

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### Intelligent Transportation Systems Lab, Florida Atlantic University

July 2022 – Present

*Postdoctoral Research Fellow*

*Boca Raton, FL*

- Researching the network wide impacts of Electric Vehicles (EV) penetration on roadway capacity:
  - Part of the team for collecting the EVs trajectory data in a controlled experiment setting.
  - Conducted preliminary analysis to understand EVs response during car following and lane changing maneuvers.
- Assisted the Florida Department of Transportation (FDOT) with developing an evaluation plan to measure the impacts of deployment of Connected Vehicles (CV) in Palm Beach County.
  - Identified data collection methods and strategies through extensive literature review.
  - Met with FDOT personnels to discuss constraints in terms of available resources.
- Helping the FDOT District 4 with identifying appropriate performance measures and targets for evaluating effectiveness of Traffic Incident Management (TIM) strategies.
  - Analyzed historical incident data and reviewed incident reports published by FDOT.
  - Proposed multiple performance measures to help FDOT measure the TIM program’s effectiveness.
  - Recommended realistic performance measures targets to FDOT based on the results from the analysis.

### Complex and Sustainable Urban Networks Lab, UIC

Aug. 2017 – Dec. 2021

*PhD Candidate*

*Chicago, IL*

- Developed a methodology to group cities that have similar topological and geometrical properties of urban road networks in collaboration with researchers from TU Delft, Gustave Eiffel University, and Sharif University of Technology.
- Analyzed the articles published on Smart Cities to study articles’ objectives by organizing information using Knowledge Graphs and natural language processing methods. Identified 10 specific themes of research from 4395 scientific articles based on their objectives.
- Developed a conceptual model – urban intelligence – by adopting integrated systems’ approach to act as decision support system for policymakers in designing and prioritizing sustainable smart city policies.
- Served as a reviewer for multiple reputed journals, e.g., Physica A, Journal of Infrastructure Systems.

*Graduate Research Assistant*

*Chicago, IL*

- Identified depopulating places in Illinois and characterized them based on socio-economic and spatial variables.
  - Collected population data from US census and found 19.4% of all places in Illinois were depopulating.

- Analyzed socio-economic and spatial variables using machine learning method to determine location-specific policy variables to understand depopulation. Contributed to the writing of first draft of final report.
- Developed a framework to standardize CAD to GIS conversion process that minimizes information loss.
  - Conducted literature review to identify existing conversion methods and their limitations.
  - Illustrated the use of framework by converting underground stormwater infrastructure CAD data into georeferenced GIS data.
  - Developed a tool using decision tree learning algorithm to automatically detect errors in the converted GIS data. No such tools are currently available.
- Mentored an undergraduate student on creating synthetic CAD data for developing machine learning tools.

## PROFESSIONAL EXPERIENCE

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**Intelligent Transportation Systems Lab, Indian institute of Technology Madras**     **Aug. 2013 – June 2017**  
*Project Officer*     *Chennai, India*

- Managed a project that evaluated traffic sensors’ performance under heterogenous traffic conditions; organized and conducted 7 surveys at different locations to assess sensors’ performance under different traffic conditions, e.g., arterial roads, highways etc.
- Co-authored a technical report titled “Development and Evaluation of Traffic Sensors under Indian Traffic Conditions.”
- Collected real time traffic data, and developed a probabilistic model of time headway for different vehicle pairs to improve the heterogeneous traffic simulation accuracy; analyzed platoon dispersion characteristics and modeled their behavior.
- Collaborated with graduate students on a variety of activities including data collection, coding, and literature review. Interviewed 70+ survey participants to collect qualitative data to assist the research team in developing freight trip generation model for city of Chennai, India.
- Assisted my team with organizing the Indo-US workshop on Big Data Analysis for Transportation Engineering Systems hosted by IIT Madras.

## TEACHING EXPERIENCE

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**Florida Atlantic University**     **Aug. 2022 – Dec. 2022**  
*Instructor*     *Boca Raton, FL*

- Taught a course that covers the fundamentals of traffic engineering to 44 students at the undergraduate level.
- Evaluated and graded students’ exam and lab projects.
- Oversaw the work of a graduate teaching assistant, who assisted me with grading homework.
- Taught software such as AIMSUN and Synchro to students.
- Held weekly in-person office hours to help struggling students understand the important traffic engineering concepts.

**University of Illinois Chicago**     **Jan. 2018 – Dec. 2021**  
*Teaching Assistant*     *Chicago, IL*

### **Water Resource Engineering**

- Delivered lectures on seepage analysis, flow nets to a classroom of 40+ students.
- Conducted labs to a class of 50+students, which involved explaining theories and lab procedures.
- Engaged with students on a weekly basis to assist them with homework.
- Taught software such as SeepW, ArcGIS, and EPANET as a part of the lab assignments.

### **Mechanics of Materials**

- Supervised midterm exams.
- Kept a weekly office hour to engage with students and help them with homework.
- Graded the students’ homework on time.

## JOURNAL PUBLICATIONS

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- Lapardhaja, S, Yagantekin, KU, Yang, M, Majumder, TA, **Badhrudeen, M**, and Kan, D. “Unlocking the Potential Capacity Improvement from Adopting Electric Vehicles (EVs) with Adaptive Cruise Control (ACC) – Field Experiments and Open Database.” *Transportation Research Part C*, Under Review.

- Sutradhar, U, **Badhrudeen, M**, Chauhan, RS, and Derrible, S. “A Survey to Investigate Transport Conditions in Depopulating Cities in Illinois.” *Transportation Research Interdisciplinary Perspectives*, 2023, Vol 21, Article 100886.
- **Badhrudeen M**, Derrible S, Verma T, Kermanshah A, and Furno A. “A Geometric classification of World Urban Road Networks.” *Urban Science*, 2022, 6(1), 11.
- **Badhrudeen M**, Boria E, Fonteix G, Derrible S, and Siciliano M. “The C2G Framework to convert infrastructure data from Computer Aided Drawing (CAD) to Geographic Information Systems (GIS).” *Informatics*, 2022, 9(2), 42.
- Balasubramani BS, **Badhrudeen M**, Derrible S, and Cruz I. “Smart data management of urban infrastructure using Geographic Information Systems.” *Journal of Infrastructure Systems*, 2020, 26(4).
- **Badhrudeen M**, Vanajakshi LD, Subramanian SC, Sharma A, Thomas H. “Recurrence Theory – Based Platoon Analysis under Indian Traffic Conditions.” *Journal of Transportation Engineering, Part A: Systems* 2018, 144(8).
- **Badhrudeen M**, Thomas H, Vanajakshi LD, Sharma A. “Platoon Dispersion Analysis based on Diffusion theory.” *6<sup>th</sup> International Conference on Transportation and Traffic Engineering (ICTTE)*, 124, 01003, 2017.
- **Badhrudeen M**, Raj J, Vanajakshi L.D. “Short Term Prediction of Traffic Parameters -- Performance Comparison of Data Driven and Less Data Required Approaches.” *Journal of Advanced Transportation*, 2016, 50(4), pp. 647-666.
- **Badhrudeen M**, and Derrible S. “Knowledge graph extraction from the smart cities literature in the context of urban infrastructure.” *In Preparation*.

## CONFERENCE PUBLICATIONS AND PRESENTATIONS

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- **Badhrudeen M**, Naranjo N, Movahedi A, and Derrible S. “Machine learning based tool for identifying errors in CAD to GIS converted data.” In: Ha-Minh C., Dao D., Benboudjema F., Derrible S., Huynh D., Tang A. (eds) CIGOS 2019, *Innovation for Sustainable Infrastructure*. Lecture Notes in Civil Engineering, vol 54. Springer, Singapore.
- **Badhrudeen M**, Ramesh V, Vanajakshi LD. “Headway Analysis using Automated Sensor Data under Indian Traffic Conditions.” *11<sup>th</sup> Transportation Planning and Implementation Methodologies for Developing Countries*, Transportation Research Procedia, 2016, 17, pp. 331- 339.
- Maripini, H, **Badhrudeen, M**, Vanajakshi, LD. “Analysis of Indian Traffic Characteristics using Automated Sensor Data.” *4<sup>th</sup> Conference on Transportation Systems Engineering and Management*, Anna University, Chennai, India, May 12 – 13, 2017.
- **Badhrudeen M**, Derrible S, Verma T, Kermanshah A, and Furno A. “A Geometric classification of World Urban Road Networks.” *Presented at Christopher B. and Susan S. Burke Civil Engineering Graduate Student Poster Competition*, University of Illinois at Chicago, April 19, 2019.
- **Badhrudeen M**, Boria E, Fonteix G, Derrible S, and Siciliano M. “A framework to convert infrastructure data from Computer Aided Drawing (CAD) to Geographic Information Systems (GIS): C2G Framework.” *Presented at the GISDay, Urban Data Visualization lab, College of Urban Planning and Public Affairs, UIC*, 2018.
- **Badhrudeen M**, Raj J, Vanajakshi LD. Short Term Prediction of Traffic Parameters – Performance Comparison of Data Driven and Less Data Required Approaches. *Transportation Research Board 93rd Annual Meeting*, Washington DC, USA, January 12 – 16, 2014.
- Kalaanidhi S, Gunasekaran K, **Badhrudeen M**, Velmurugan S. Review of Data Collection Methods for Establishing the Capacity of Intercity Highway. *Presented at the 11th Transportation Planning and Implementation Methodologies for Developing Countries*, IIT Bombay, Mumbai, India, December 10 – 12, 2014.
- **Badhrudeen M**, Thomas H, Vanajakshi LD, Sharma A. “Platoon Dispersion Analysis based on Diffusion theory.” *6<sup>th</sup> International Conference on Transportation and Traffic Engineering (ICTTE)*, 124, 01003, 2017.

## TECHNICAL REPORT

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- “**Development and Evaluation of Traffic Sensors under Indian Traffic Conditions**”, Center of Excellence in Urban Transport, Indian Institute of Technology Madras, Sponsored by Ministry of Urban Development, Government of India, 2016. Available at: [https://coeut.iitm.ac.in/Sensor\\_Evaluation%20Report.pdf](https://coeut.iitm.ac.in/Sensor_Evaluation%20Report.pdf).

## SKILLS & INTERESTS

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- **Certifications:** Passed FE exam.
- **Computer:** Python, R, MATLAB, GitHub, AutoCAD, ArcGIS, EPANET (Water distribution systems modeling software), SeepW (groundwater flow modeling program).
- **Analytical:** Statistical analysis, probabilistic modeling, network analysis, predictive modeling, simulation, web scraping, natural language processing, data science.
- **Soft:** Organizational ability, quick learner, literature review, presentation, multitasking, teamwork, problem solving.
- **Language:** English (fluent), Tamil (native), Hindi (basic).
- **Interests:** eastern philosophies; sustainability; mythologies; meditation.

## RELEVANT COURSE PROJECTS

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### Transportation System Analysis

- Developed an optimization algorithm to identify individual rides that has the potential to be converted into shared rides.
- Collected individual rides data from a dynamic rideshare platform called RideAustin.
- Grouped the individual rides with others based on the waiting time and distance restrictions.
- Developed method grouped 85% of individual trips, thus reducing 2200 km from the total distances travelled.

### Causal Inference and Learning

- Analysed the socio-economic and travel behaviour variables to understand the causal nature of mode choice behaviour of individuals: car, bus, rail, bike, etc.
- Used the 2017 National Household Travel Survey data for this study.
- Employed different causal structure learning methods including Bayesian networks-based algorithms (PC and FCI) to identify causal structure influencing the mode choices.
- Overcame the problem of mixed data types by adopting Copula method, which was implemented in R to estimate the covariance matrix for mixed data types.
- Combined the covariance matrix to the PC algorithm and FCI method to learn the causal representations of different variables.