Mohammed Abdalazeem

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EDUCATION

University of Massachusetts Amherst — *Expected Sep 2026*
PhD in Civil Engineering (Transportation Systems) — *Amherst, MA*

- Dissertation: *Data-Driven Approaches to Transit Demand, Urban Safety, and Micromobility Infrastructure*
- Advisor: Dr. Jimi Oke | GPA: 3.92 | CEE Departmental Fellowship (2023)

University of Massachusetts Amherst — *December 2025*
MS in Computer Science — GPA: 3.71 — *Amherst, MA*

University of Massachusetts Amherst — *May 2024*
MS in Civil Engineering — GPA: 3.92 — *Amherst, MA*

University of Khartoum — *November 2018*
BSc in Civil Engineering, First Class Honors — *Khartoum, Sudan*

RESEARCH EXPERIENCE

Graduate Research Assistant — *Jan 2021 – Present*
University of Massachusetts Amherst — *Amherst, MA*

Schematic Bicycle Map Design and Micromobility Behavior

- Conducted a national landscape study of 684 US urban counties to characterize schematic bicycle map adoption using Bayesian mixture modeling, XGBoost, and SHAP analysis, identifying three distinct county typologies.
- Designed and deployed an incentivized online survey assessing cyclist and micromobility rider preferences for map design features: simplification level, geographic accuracy, infrastructure representation, and route legibility.
- Developed a Bayesian latent class ordered logistic regression framework to identify heterogeneous rider groups and model stated intentions to use micromobility under different map design conditions.
- Built a mixed-integer linear programming (MILP) optimization framework to select optimal bicycle map routes from street and trail networks, incorporating safety, connectivity, and user-preference constraints.
- Developed a multi-filter bot detection pipeline (platform signals, browser fingerprinting, timing analysis, XGBoost validation) for online survey quality control.
- *Funding: Armstrong Fund for Science, 2024–2026 (PI: J. Oke); NSF REU, 2023–2025.*

Spatial Crash Typology and Risk Prediction

- Applied UMAP and Gaussian mixture models to classify 2,480 New England census tracts into crash typologies using one year of state-level crash records.
- Identified spatial patterns in crash frequency and severity linked to roadway geometry, land use, and socioeconomic factors across urban, suburban, and rural profiles.
- Built XGBoost predictive models with SHAP-based interpretation to forecast crash risk by typology, surfacing actionable feature importance for targeted safety interventions.
- *Funding: New England University Transportation Center (NEUTC), 2024–2025 (PI: J. Oke).*

Transit OD Inference from Partial Mobile Ticketing Data

- Built a machine learning framework to infer complete origin-destination-transfer matrices from boarding-only mobile ticketing data in a regional bus network with 40+ routes.
- Developed passenger typology clustering using hierarchical methods and dynamic time warping to capture behavioral heterogeneity across 40,000+ weekly riders.
- Integrated gradient boosting spatial error correction, reducing MAE by 70% and SMAPE by 85% vs. baseline trip chaining models.
- *Funding: Pioneer Valley Transit Authority (PVTA), 2021–2023 (PI: J. Oke).*

PUBLICATIONS

Journal Articles (Published)

1. Ruger, A., Abdalazeem, M., Christofa, E., & Oke, J. (2026). Explainable Data-Driven Multi-Filter Framework for Bot Detection in Incentivized Online Surveys. *Data Science for Transportation*. *In press.*
2. Abdalazeem, M., Altayb, G., Christofa, E., & Oke, J. (2026). Maps are good but are simpler maps better? Insights on urban bicycling in the US. *Environmental Research Communications*, 8(2), 025004. DOI
3. Zhao, P., Mega, J., Abdalazeem, M., Arabi, M., Barchers, C. V., & Oke, J. (2026). Scenario discovery framework aids robust regional emissions mitigation planning. *Environmental Research Communications*, 8(3), 031008. DOI
4. Abdalazeem, M., & Oke, J. (2025). A Roadway Crash Typology of Census Tracts Enables Targeted Interventions via Interpretable Machine Learning. *Data Science for Transportation*, 7, 14. DOI
5. Abdalazeem, M., & Oke, J. (2024). Enhanced Seasonal Typology-Informed Transit Trip Chaining via Mobile Boarding and Survey Data. *Data Science for Transportation*, 6, 19. DOI
6. Abdalazeem, M., & Oke, J. (2023). Extracting Spatiotemporal Bus Passenger Trip Typologies from Noisy Mobile Ticketing Boarding Data. *Data Science for Transportation*, 5, 20. DOI
7. Abdalazeem, M., & Oke, J. (2023). Origin-destination inference in public transportation systems: A comprehensive review. *International Journal of Transportation Science and Technology*, 12(1), 315–328. DOI
8. Abdalazeem, M., Mohammed, O., Ibrahim, M., & Osman, H. G. (2020). Khartoum sky trains network: A study on implementing caterpillar trains concept in Khartoum. *MATEC Web of Conferences*, 308, 02003. DOI

Under Review

1. Abdalazeem, M., Oke, T., & Oke, J. A novel origin-destination-transfer model using mobile ticketing activations with seasonal passenger typology and spatial error correction.
2. Abdalazeem, M., Christofa, E., Barchers, C., & Oke, J. Toward Unified Design Rules for Schematic Bicycle Maps.
3. Abdalazeem, M., Ruger, A., Christofa, E., & Oke, J. Schematic maps promise to induce micromobility ridership: a Bayesian latent class ordered logistic approach.

In Preparation

1. Abdalazeem, M., Christofa, E., & Oke, J. Schematic Bicycle Maps for Influencing Cyclist Behavior and Reducing Greenhouse Gas Emissions.
2. Bohlke, N., Bell, H., Abdalazeem, M., Oke, J., & Christofa, E. Barriers to Cycling: A comprehensive literature review.

TEACHING EXPERIENCE

Teaching Assistant — CE-ENGIN 260: Probability & Statistics for Civil Engineers *Fall 2024, Fall 2025*
University of Massachusetts Amherst *Amherst, MA*

- Taught classes, led lab sessions, and delivered a full lecture; held weekly office hours on probability theory, statistical inference, and experimental design.
- Supported cohorts of **~160 students** each semester; graded exams, prepared solution guides, and rubric-based feedback.

Teaching Assistant — CE-ENGIN 310: Transportation Systems *Fall 2023*
University of Massachusetts Amherst *Amherst, MA*

- Supported students in transportation operations, network planning, and geometric design; prepared problem sets on traffic flow, capacity analysis, and signal control.

Teaching Assistant — Multiple Civil Engineering Courses *Nov 2018 – Dec 2020*
University of Khartoum *Khartoum, Sudan*

- Taught undergraduate courses: Environmental Engineering, Highway Engineering, Strength of Materials, Reinforced Concrete Design, and Theory of Structures.
- Supervised lab sessions on water quality analysis and material testing.

MENTORSHIP

Research Mentor, NSF REU Program *Summers 2023, 2024, 2025*
University of Massachusetts Amherst *Amherst, MA*

- **Andrew Ruger** (Grinnell College): Survey data quality and micromobility mapping; bot detection in incentivized online surveys.
- **Geehan Altayb** (Howard University): Bicycle map features and their influence on cycling behavior.
- **Vivian Rost-Nasshan** (RPI): Vehicular delay patterns using network topology and demographic data.

Research Mentor *Spring 2026*
University of Massachusetts Amherst *Amherst, MA*

- **Henry Bell** (UMass Amherst): Comprehensive literature review on barriers to cycling.

CONFERENCE PRESENTATIONS

Lectern Presentations

1. Abdalazeem, M., Oke, T., & Oke, J. (2025). A Typology-Informed Origin-Destination-Transfer Model for a Bus Transit Network using Mobile Ticketing Data. *TRB Annual Meeting, Washington, D.C.*
2. Abdalazeem, M., & Oke, J. (2024). Enhancing Road Safety: A Data-Driven Spatial Typology of Crashes in New England. *INFORMS Annual Meeting, Seattle, WA.*
3. Abdalazeem, M., & Oke, J. (2023). Typology-Enhanced Origin-Destination-Transfer Inference from Noisy Mobile Boarding Observations. *INFORMS, Phoenix, AZ.*
4. Abdalazeem, M., & Oke, J. (2023). Spatiotemporal Trip Chaining Framework for Open Mobile Fare Collection Systems. *TRB Annual Meeting, Washington, D.C.*
5. Abdalazeem, M., & Oke, J. (2022). Spatio-Temporal Trip Pattern Typology Analysis for a Regional Bus Network. *INFORMS, Indianapolis, IN.*

Poster Presentations

1. Abdalazeem, M., Christofa, E., & Oke, J. (2025). Optimizing and Deploying Schematic Bicycle Maps with MILP and User Input. *INFORMS Annual Meeting, Atlanta, GA.*
2. Abdalazeem, M., & Oke, J. (2025). A Roadway Crash Typology of Census Tracts Enables Targeted Interventions via Interpretable Machine Learning. *NEUTC Symposium, Norwich University, Northfield, VT.*
3. Abdalazeem, M., & Oke, J. (2025). A Spatial Typology Analysis of Crash Characteristics across 2,480 Census Tracts. *TRB Annual Meeting, Washington, D.C.*
4. Abdalazeem, M., & Oke, J. (2022). Trip Pattern Typologies in The Pioneer Valley Bus Transit System. *TRB Annual Meeting, Washington, D.C.*
5. Abdalazeem, M., & Oke, J. (2022). Efficient Extraction of Spatiotemporal Bus Passenger Trip Patterns in the Pioneer Valley Bus Transit System. *MassDOT Transportation Innovation Conference, Worcester, MA.*

PROFESSIONAL SERVICE

Manuscript Reviewing

- *Discover Public Health* (Springer Nature), 2026
- *Journal of Transportation Engineering, Part A: Systems* (ASCE), 2026
- *npj Environmental Social Sciences* (Springer Nature), 2026
- *Scientific Reports* (Springer Nature), 2025, 2026
- *Security Journal* (Springer Nature), 2025, 2026
- *Scientific Data* (Nature Publishing Group), 2025
- *Applied Network Science* (Springer Nature), 2025
- *European Transport Research Review* (Springer Nature), 2024
- *Applied Intelligence* (Springer Nature), 2022, 2023

Conference Reviewing

- Transportation Research Board (TRB) Annual Meeting, paper reviewer (2022, 2023, 2025)

Leadership & Service

- Treasurer, Graduate Student Association, Dept. of Civil and Environmental Engineering, UMass Amherst (2023–2024). Managed budgeting and event coordination for graduate student activities.

TECHNICAL SKILLS & METHODS

Statistical Modeling	Bayesian inference, mixture models, latent class analysis, ordered outcome models, spatial econometrics
Machine Learning	Gradient boosting, unsupervised clustering, dimensionality reduction, interpretable ML (SHAP)
Optimization	Mixed-integer linear programming, network optimization
Survey Methods	Stated preference design, incentivized panel deployment, data quality assurance
Geospatial	Census-level spatial analysis, transit network analysis, GIS
Transportation	Transit demand modeling, OD inference, micromobility, road safety analysis
Software	Python, SQL, Git, GeoPandas, QGIS, Scikit-learn, XGBoost, Pandas, Matplotlib

AWARDS & HONORS

- Graduate School Travel Awards (2022, 2023, 2024)
- First Class Honors (Summa Cum Laude Equivalent), BSc Civil Engineering, University of Khartoum (2018)
- Best Project Award, University of Khartoum Civil Engineering Department (2018)

PROFESSIONAL AFFILIATIONS

- Institute of Transportation Engineers (ITE)
- American Society of Civil Engineers (ASCE)
- Institute for Operations Research and the Management Sciences (INFORMS)
- Institute of Electrical and Electronics Engineers (IEEE)