

EDUCATION

University of Massachusetts Amherst

PhD in Civil Engineering (Transportation Systems)

Jan 2021 – Expected Fall 2026

Amherst, MA

- Dissertation: *Machine Learning and Optimization for Schematic Bicycle Map Design and Cycling Behavior*
- Advisor: Dr. Jimi Oke | GPA: 3.92 | CEE Departmental Fellowship (2023)

University of Massachusetts Amherst

MS in Computer Science — GPA: 3.71

Sep 2023 – Dec 2025

Amherst, MA

University of Massachusetts Amherst

MS in Civil Engineering — GPA: 3.92

Jan 2021 – May 2024

Amherst, MA

University of Khartoum

BSc in Civil Engineering, First Class Honors

Sep 2013 – Nov 2018

Khartoum, Sudan

RESEARCH EXPERIENCE

Graduate Research Assistant

University of Massachusetts Amherst

Jan 2021 – Present

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.*
- *Publications: 2 published, 3 under review, 1 in preparation.*

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).*
- *Publications: 1 published.*

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: 3 published, 1 working paper.*

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*, 8, 21. [DOI](#)
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](#)

Conference Papers

1. 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., Christofa, E., Barchers, C., & Oke, J. Toward Unified Design Rules for Schematic Bicycle Maps.
2. Abdalazeem, M., Ruger, A., Christofa, E., & Oke, J. Schematic maps promise to induce micromobility ridership: a Bayesian latent class ordered logistic approach.
3. Bohlke, N., Bell, H., Abdalazeem, M., Oke, J., & Christofa, E. Three-decade systematic review highlights enduring barriers to cycling and reveals rural–urban evidence gap.

In Preparation

1. Abdalazeem, M., Christofa, E., & Oke, J. Schematic Bicycle Maps for Influencing Cyclist Behavior and Reducing Greenhouse Gas Emissions.
2. Abdalazeem, M., Oke, T., & Oke, J. A novel origin-destination-transfer model using mobile ticketing activations with seasonal passenger typology and spatial error correction.

TEACHING EXPERIENCE

Teaching Assistant — CE-ENGIN 260: Probability & Statistics for Civil Engineers

University of Massachusetts Amherst

Fall 2024, Fall 2025

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

University of Massachusetts Amherst

Fall 2023

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

University of Khartoum

Nov 2018 – Dec 2020

Khartoum, Sudan

- Taught and led tutorials for undergraduate courses:
 - Environmental Engineering

- Highway Engineering
- Strength of Materials
- Reinforced Concrete Design
- Theory of Structures
- Supervised lab sessions on water quality analysis and material testing.

MENTORSHIP

Research Mentor, NSF REU Program

University of Massachusetts Amherst

Summers 2023–2026

Amherst, MA

- **Julianna Demers** (UMass Amherst), Summer 2026: Unified geospatial data pipeline for schematic bicycle map generation.
- **Andrew Ruger** (Grinnell College), Summer 2025: Survey data quality and micromobility mapping; bot detection in incentivized online surveys. (*1 publication, published*)
- **Geehan Altayb** (Howard University), Summer 2024: Bicycle map features and their influence on cycling behavior. (*1 publication, published*)
- **Vivian Rost-Nasshan** (RPI), Summer 2023: Vehicular delay patterns using network topology and demographic data.

Research Mentor

University of Massachusetts Amherst

Spring 2026

Amherst, MA

- **Henry Bell** (UMass Amherst), Spring 2026: Comprehensive literature review on barriers to cycling. (*1 publication, under review*)

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

- Coordinator, Graduate Writing Lab, College of Engineering, UMass Amherst (Spring 2025). Facilitated weekly writing sessions and provided feedback on graduate student manuscripts.
- Treasurer, Graduate Student Association, Dept. of Civil and Environmental Engineering, UMass Amherst (Sep 2021 – Sep 2022). 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

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

PROFESSIONAL AFFILIATIONS

- ELEVATE Affiliate, Energy Transition Institute, UMass Amherst
- 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)