

EDUCATION

University of Massachusetts Amherst

PhD in Civil Engineering (Transportation Systems)

Expected Sep 2026

Amherst, MA

- Dissertation: *Machine Learning for Transit OD Inference, Crash Risk Prediction, and Bicycle Network Optimization*
- Advisor: Dr. Jimi Oke | GPA: 3.92 | CEE Departmental Fellowship (2023)

University of Massachusetts Amherst

MS in Computer Science (GPA: 3.71) | MS in Civil Engineering (GPA: 3.92)

December 2025 / May 2024

Amherst, MA

University of Khartoum

BSc in Civil Engineering, First Class Honors

November 2018

Khartoum, Sudan

RESEARCH & PROJECT EXPERIENCE

Graduate Research Assistant

University of Massachusetts Amherst

Jan 2021 – Present

Amherst, MA, USA

Transit OD Inference from Mobile Ticketing Data (PVTA)

- Built an ML pipeline to infer complete origin-destination-transfer matrices from boarding-only mobile ticketing records across a 40+ route regional bus network, reducing MAE by 70% and SMAPE by 85% over baseline trip-chaining models.
- Modeled passenger behavioral heterogeneity across 40,000+ weekly riders using hierarchical clustering and dynamic time warping, producing seasonal rider typologies.
- Deployed a public-facing interactive OD dashboard for PVTA (pvtaodx.narslab.org), built with Plotly Dash, containerized and hosted on AWS Lightsail.

Spatial Crash Typology and Risk Prediction (New England)

- Integrated crash records, roadway geometry, land use, and socioeconomic attributes for 2,480 New England census tracts. Applied UMAP and Gaussian mixture modeling to classify tracts into safety typologies.
- Developed XGBoost predictive models with SHAP-based interpretation to forecast crash risk by typology and identify high-impact features for targeted safety interventions.

Schematic Bicycle Map Design and Micromobility Behavior

- Analyzed schematic bicycle map adoption patterns across 684 US urban counties using Bayesian mixture modeling, XGBoost, and SHAP, producing three county typologies to inform national map design guidance.
- Built a MILP optimization framework to select optimal bicycle network routes for schematic mapping, balancing safety, connectivity, and user-preference constraints across street and trail networks.
- Designed and deployed an incentivized stated preference survey to quantify cyclist and micromobility rider preferences. Developed a Bayesian latent class ordered logistic model to estimate heterogeneous ridership responses to map design conditions.
- Developed a multi-filter bot detection pipeline (browser fingerprinting, timing analysis, XGBoost) for survey data quality control. Methodology published in *Data Science for Transportation*.

Regional Emissions Scenario Discovery (Connecticut)

- Contributed to a scenario discovery framework for robust regional emissions mitigation planning. Results published in *Environmental Research Communications* (2026).
- Built and deployed a public-facing GHG inventory dashboard for Connecticut Councils of Governments (ctghginventory.narslab.org) using Apache Superset connected to a SQL database on a Linux server, hosted on AWS Lightsail.

SELECTED PUBLICATIONS

† Corresponding author. Full list: mabdalazeem.com

1. **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.
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.
3. **Abdalazeem, M.[†]** & Oke, J. (2024). Enhanced seasonal typology-informed transit trip chaining via mobile boarding and survey data. *Data Science for Transportation*, 6, 19.
4. 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.

CONFERENCE PRESENTATIONS

- A Typology-Informed OD-Transfer Model for a Bus Transit Network using Mobile Ticketing Data. *TRB Annual Meeting, 2025* Lectern
- Data-Driven Spatial Crash Typology of Census Tracts in New England. *INFORMS Annual Meeting, 2024* Lectern
- Optimizing and Deploying Schematic Bicycle Maps with MILP and User Input. *INFORMS Annual Meeting, 2025* Poster
- A Spatial Typology Analysis of Crash Characteristics across 2,480 Census Tracts. *TRB Annual Meeting, 2025* Poster
- Typology-Enhanced OD-Transfer Inference from Mobile Boarding Observations. *INFORMS Annual Meeting, 2023* Lectern
- Spatiotemporal Trip Chaining for Open Mobile Fare Collection Systems. *TRB Annual Meeting, 2023* Lectern

TEACHING & MENTORSHIP

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

Fall 2024, Fall 2025

University of Massachusetts Amherst

Amherst, MA

- Led lab sessions, delivered lectures, and held weekly office hours for cohorts of ~160 students each semester.

Teaching Assistant, CE-ENGIN 310: Transportation Systems

Fall 2023

University of Massachusetts Amherst

Amherst, MA

- Prepared problem sets and supported students in network planning and traffic flow analysis.

Research Mentorship, NSF REU Program (Summers 2023, 2024, 2025)

- Mentored three undergraduate researchers in transportation data analysis and programming. All three contributed to peer-reviewed research outputs.

TECHNICAL SKILLS

Languages & Tools	Python, SQL, Git/GitHub
Data & ML	Scikit-learn, XGBoost, Pandas, Matplotlib, Plotly Dash, Apache Superset
Geospatial	GeoPandas, QGIS, census-level spatial analysis, transit network analysis
Statistics	Bayesian inference, mixture models, latent class analysis, spatial econometrics
ML Methods	Gradient boosting, unsupervised clustering, dimensionality reduction, SHAP
Optimization	Mixed-integer linear programming, network optimization
Survey Methods	Stated preference design, incentivized panel deployment, data quality assurance
Infrastructure	AWS Lightsail (cloud deployment), Linux server administration
Transportation	Transit demand modeling, OD inference, crash risk modeling, micromobility

PROFESSIONAL SERVICE & AFFILIATIONS

- Peer reviewer for 9+ journals including *npj Environmental Social Sciences*, *Journal of Transportation Engineering* (ASCE), *Scientific Reports*, and *Data Science for Transportation*. TRB annual conference paper reviewer (2022, 2023, 2025).
- Treasurer, Graduate Student Association, Dept. of Civil & Environmental Engineering, UMass Amherst (2023–2024).
- Member: ITE, ASCE, INFORMS, IEEE.

AWARDS

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