

# Ahmed Kamel

## Research Engineer

Vancouver, BC, Canada

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### PROFILE

Research Engineer (PhD) with 9+ years building and productionizing advanced statistical, ML and optimization solutions for transportation, road-safety and insurance analytics. Expert in Bayesian hierarchical & extreme-value modeling, probabilistic risk estimation, and translating research models into deployable systems (model ops, pipelines, dashboards) that support enforcement, investment and claims decisions. Hands-on with Python/R/SQL, geospatial engineering, and RAG/LangChain + NLP for integrating unstructured sources into decision workflows. Focused on safety & mobility but adaptable to other high-stakes domains; proven at turning complex data (AV trajectories, crash histories, LiDAR) into operational decision support.

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### CORE SKILLS

- Bayesian & probabilistic modeling (hierarchical, spatial, EVT)
  - Machine learning & NLP; Retrieval-Augmented Generation (RAG) / LangChain workflows
  - Optimization & decision models (stochastic, GA, MILP)
  - Model production (pipelines, reproducibility, deployment)
  - Data engineering & geospatial analytics (Python, R, SQL, ArcGIS/QGIS)
  - Decision support (dashboards, scenario / sensitivity analysis, stakeholder reporting)
  - Traffic & simulation tools (VISSIM, VISUM, Synchro, SIDRA)
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### PROFESSIONAL EXPERIENCE

#### Road Safety Researcher

## **ICBC & BC Injury Research and Prevention Unit (BCIRPU) — Vancouver, BC**

**Mar 2025 – Present**

- Produced deployment-ready methodologies for enforcement, roadway safety assessment, and data-driven decision support, leveraging state-of-the-art modeling and optimization techniques.
  - Implemented stochastic optimization modules (genetic algorithms + scenario simulation) to prioritize enforcement and infrastructure under budget constraints; demonstrated a modeled reduction of ~186 crashes/year at a \$5M deployment budget.
  - Deployed interactive dashboards exposing heatmaps, scenario outputs, and quantified uncertainties to planners and enforcement teams — shortened decision cycles and improved prioritization transparency.
  - Achieved a ~60% improvement in crash risk prediction accuracy by implementing spatial hierarchical Bayesian models, capturing geographic correlation and unobserved heterogeneity beyond industry-standard methods.
  - Developed improved collision prediction models (~23% accuracy gain) using machine learning and Bayesian approaches—supporting infrastructure investment decisions.
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## **Traffic Technologist / Applied Data Analyst**

**City of Coquitlam — Coquitlam, BC**

**Aug 2023 – Sep 2024**

- Conducted data-driven safety analyses across urban road networks, identifying high-risk locations and operational bottlenecks using historical collision, exposure, and contextual data.
- Applied causal reasoning and evidence-based evaluation methods to assess safety interventions and inform project prioritization.
- Analyzed trade-offs between safety, mobility, and operational efficiency using simulation outputs, crash data, and surrogate safety metrics.
- Developed and enhanced analytical dashboards (near-miss, conflict, collision trends) to support proactive monitoring and intervention.

- Collaborated with engineering, planning, enforcement, and emergency services to align analytics with operational and policy objectives.
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### **Graduate Researcher / Applied Data Scientist (PhD)**

**University of British Columbia (UBC)** — Vancouver, BC

**Jan 2020 – Jan 2025**

- Utilized best practices to assess safety countermeasures effectiveness to Ministry of Transportation and Transit.
  - Developed Bayesian hierarchical and spatial models to estimate real-time crash risk, explicitly accounting for unobserved heterogeneity across diverse urban traffic environments.
  - Applied Extreme Value Theory (EVT) to model rare, high-risk events, enabling reliable prediction beyond traditional regression-based approaches.
  - Designed transfer learning frameworks using informed priors and model recalibration to deploy safety models in data-scarce settings, achieving stable performance with as little as ~20% of historical data.
  - Built end-to-end data pipelines to process and engineer features from 1,000+ hours of high-resolution autonomous vehicle trajectory data, including surrogate safety and mobility metrics.
  - Conducted rigorous model validation and selection to balance predictive accuracy and generalizability in sparse, noisy datasets.
  - Translated complex statistical findings into decision-ready metrics and recommendations for government and industry partners.
  - Performed drone-based data collection, 3D reconstruction of roadway surfaces, object tracking, and LiDAR processing for geometric and terrain analysis.
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### **Transportation Engineer (Analytics-Focused)**

**SETS International** — Cairo, Egypt

**Dec 2015 – Sep 2019**

- Led data-driven analyses supporting infrastructure planning, operational performance, and safety assessment for large-scale transportation projects.

- Conducted extensive field data collection and supervised teams, ensuring data quality and analytical integrity.
  - Delivered stakeholder-facing reports emphasizing risk, trade-offs, and evidence-based recommendations.
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## EDUCATION

### **PhD — Transportation Engineering (Road Safety)**

University of British Columbia

### **MSc — Traffic Engineering**

Cairo University

### **BSc — Civil Engineering**

Cairo University

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## SELECTED PUBLICATIONS

- Kamel, A., Sayed, T. and Fu, C., 2023. “Real-time safety analysis using autonomous vehicle data: a Bayesian hierarchical extreme value model”. *Transportmetrica B: Transport Dynamics*, 11(1), pp.826-846
- Kamel, A., Sayed, T. and Kamel, M., 2024. “Real-time combined safety-mobility assessment using self-driving vehicles collected data”. *Accident Analysis & Prevention*, 199, p.107513
- Kamel, A. and Sayed, T., 2024. “Transferability of real-time EVT safety models: an investigation using autonomous vehicles data”. *Transportmetrica A: Transport Science*, pp.1-26.
- Kamel, A., Sayed, T., 2025 “Real-time crash risk estimation with Autonomous Vehicle Data: A Comparative Analysis of Extreme Value Models. *Transportmetrica A: Transport Science*.