

Eunhan Ka

PH.D. CANDIDATE · LYLES SCHOOL OF CIVIL AND CONSTRUCTION ENGINEERING, PURDUE UNIVERSITY

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Education

Purdue University

United States

DOCTOR OF PHILOSOPHY (PH.D.), LYLES SCHOOL OF CIVIL AND CONSTRUCTION
ENGINEERING

Aug. 2020 - present

- Topic Keywords: Network Traffic Dynamics, Connected and Autonomous Vehicles, Cyber Security, Deep Learning, Network Science
- Advisor: Dr. Satish V. Ukkusuri

Seoul National University

South Korea

MASTER OF SCIENCE (M.S.), DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING

Feb. 2018

- Thesis: A Simulation Study of Demand Responsive Transport for the Disabled to Minimize User Waiting Time
- Advisor: Dr. Chungwon Lee

Seoul National University

South Korea

BACHELOR OF SCIENCE (B.S.), DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING

Feb. 2016

Research Experience

Graduate Research Assistant

Aug. 2020 - Present

PURDUE UNIVERSITY

- Develop a pioneering framework to bolster road network resilience against cyber-attacks in extensive road networks and mitigate cyber attack's impact by using defense strategies. **(Sponsor: USDOT)**
- Introduce a groundbreaking framework for modeling traffic dynamics using physics-informed deep learning, enabling predictions of traffic impacts due to connected and autonomous vehicles in cyber-physical systems within large-scale urban areas.
- Predict origin-destination (OD) matrices by using mobile location data **(Sponsor: INDOT)**
- Analyze the traffic impact of movable barrier (Alex Fraser Bridge) in Vancouver by leveraging the mobile location data with static traffic assignment **(Sponsor: Lindsay Corporation)**

Researcher

Mar. 2018 - Aug. 2020

SEOUL NATIONAL UNIVERSITY

- Led a study on designing a cluster-based route of multi-capacity vehicles of demand-responsive transport services for the disabled **(Sponsor: T-Money Welfare Foundation, South Korea)**
- Developed optimal operation strategies of Mobility-as-a-Service (MaaS) for the mobility impaired **(Sponsor: National Research Foundation of Korea, South Korea)**
- Modelled lane change behaviors on freeways and gap acceptance behaviors at roundabouts in real driving situations and virtual reality **(Sponsor: Ministry of Land, Infrastructure and Transport, South Korea)**
- Collaborated and coordinated with faculty members, businessmen, researchers, and graduate students at University of Seoul, Radius Corporation, Korea Land & Housing Institute

Graduate Research Assistant

Mar. 2016 - Feb. 2018

SEOUL NATIONAL UNIVERSITY

- Designed a real-time relocation strategy for one-way car-sharing and developed an event-based simulation for one-way car-sharing services (**Sponsor: National Research Foundation of Korea**)
- Led a study on improving demand-responsive transport services for the disabled with shared mobility in Seoul (**Sponsor: T-Money Welfare Foundation, South Korea**)
- Developed an evaluation method to evaluate drivers' behaviors with surrogate safety measures (**Sponsor: Ministry of Land, Infrastructure and Transport, South Korea**)
- Collaborated and coordinated with faculty members, businessmen, and researchers at the Korea Transport Institute, Korea Transportation Safety Authority, and InnoSim

Teaching & Mentoring Experience

Teaching Assistant

Jan. 2021 - Dec. 2024

LYLES SCHOOL OF CIVIL AND CONSTRUCTION ENGINEERING, PURDUE UNIVERSITY

- CE 661 - Algorithms in Transportation (Fall 2024, Graduate)
- CE 597 - Network Models for Connected Autonomous Vehicles (Fall 2023, Spring 2023, Spring 2022, Fall 2021, Graduate)
- CE 597 - Smart Logistics (Fall 2024, Fall 2021, Graduate)
- CE 597 - Data Science for Smart Cities (Fall 2023, Spring 2021, Graduate)

Lecturer

Nov. 2019

DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING, SEOUL NATIONAL UNIVERSITY

- Introduction to Civil and Environmental Engineering (Transportation Engineering)

Teaching Assistant

Sep. 2016 - Dec. 2017

DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING, SEOUL NATIONAL UNIVERSITY

- Sustainable Transportation Systems (Fall 2017, Undergraduate)
- Advanced Transportation Operation (Spring 2017, Graduate)
- Leadership for Civil Engineers (Spring 2017, Undergraduate)
- Introduction to Transportation Engineering (Fall 2016, Undergraduate)

Publications

UNDER REVIEW & PREPARATION

2. **Ka, E.** and Ukkusuri. S. V. (Under Review). Route Guidance Attacks in Cyber Transportation Networks: A User-Centered Study of Behavioral Sensitivity. *Transportation Research Part F: Traffic Psychology and Behaviour*.
1. **Ka, E.**, Leclercq, L., and Ukkusuri. S. V. (Under Review). Adaptive Spatial-Temporal Domain Decomposition in Physics-Informed Neural Networks for Traffic State Estimation. *26th International Symposium on Transportation and Traffic Theory (ISTTT26)*.

REFEREED JOURNAL PUBLICATIONS

5. Xue, J., **Ka, E.**, and Ukkusuri. S. V. (2024). Network Macroscopic Fundamental Diagram-Informed Graph Learning for Traffic State Imputation. *Transportation Research Part B: Methodological*, 102996. <https://doi.org/10.1016/j.trb.2024.102996>.
4. **Ka, E.**, Xue, J., Leclercq, L., and Ukkusuri. S. V. (2024). A Physics-Informed Machine Learning for Estimating Traffic State with a Generalized Bathtub Model in Large-scale Urban Networks. *Transportation Research Part C: Emerging Technologies*, 164, 104661. <https://doi.org/10.1016/j.trc.2024.104661>.

3. **Ka, E.**, Sharma, S., and Ukkusuri, S. V. (2022). Leveraging Location-Based Data for Assessing Network-Level Traffic Impact of Lane Management: A Case Study of Alex Fraser Bridge. *Journal of Transportation Engineering, Part A: Systems*, 148(12), 04022105. <https://doi.org/10.1061/JTEPBS.0000760>. **[2022 Editor's Choice Collections]**.
2. **Ka, E.**, Kim, D. G., Hong, J., and Lee, C. (2020). Implementing Surrogate Safety Measures in Driving Simulator and Evaluating the Safety Effects of Simulator-Based Training on Risky Driving Behaviors. *Journal of advanced transportation*, 2020. <https://doi.org/10.1155/2020/7525721>.
1. Lee, D., Hwang, S., **Ka, E.**, and Lee, C. (2018). Evaluation of the Rain Effects on Gap Acceptance Behavior at Roundabouts by a Logit Model. *Journal of Advanced Transportation*, 2018. <https://doi.org/10.1155/2018/2726732>.

REFEREED CONFERENCE PROCEEDINGS

17. **Ka, E.** and Ukkusuri, S. V. (2025). Analytical Framework for Network-Level Traffic Flow under Route Guidance Attacks: An Extension of the Generalized Bathtub Model. *104th Annual Meeting of the Transportation Research Board*, Washington, D.C., United States.
16. **Ka, E.** and Ukkusuri, S. V. (2025). Comparative Analysis of Sampling Methods in Physics-Informed Neural Networks for Traffic State Estimation in Large-Scale Road Networks. *104th Annual Meeting of the Transportation Research Board*, Washington, D.C., United States.
15. **Ka, E.**, and Ukkusuri, S. V. (2024). Impact of Cyber Attacks on Traffic State Estimation for Connected and Autonomous Vehicles Systems. *The Inaugural USDOT Future of Transportation (FoT) Summit*, Washington, D.C., United States.
14. Xue, J., **Ka, E.**, and Ukkusuri, S. V. (2024). Network Macroscopic Fundamental Diagram-Informed Graph Learning for Traffic State Imputation. *ISTTT25: 25th International Symposium on Transportation and Traffic Theory*, Ann Arbor, MI, United States.
13. **Ka, E.**, Xue, J., and Ukkusuri, S. V. (2024). PIDL-PedFlow: A Physics-Informed Deep Learning Approach for Macroscopic Continuum Pedestrian Flow Modelling. *103rd Annual Meeting of the Transportation Research Board*, Washington, D.C., United States.
12. Xue, J., **Ka, E.**, Mondal, W. U., and Ukkusuri, S. V. (2024). Generating Network-Level Dynamic Traffic Equations Using Symbolic Regression. *103rd Annual Meeting of the Transportation Research Board*, Washington, D.C., United States.
11. Sharma, S., and **Ka, E.** (2024). Leveraging Location-Based Data for Assessing Network Level Traffic Impact of Lane Management: A Case Study of Alex Fraser Bridge. *103rd Annual Meeting of the Transportation Research Board*, Washington, D.C., United States. *[The 3rd Journal in REFEREED JOURNAL PUBLICATIONS will be presented]*.
10. **Ka, E.**, and Ukkusuri, S. V. (2023). Dynamic Routing Games for Connected and Autonomous Vehicles with Traffic Congestion: A Mean Field Game Approach. *2023 INFORMS Annual Meeting*, Phoenix, AZ, United States.
9. **Ka, E.**, Ka, D., Jung, Y., and Lee, C. (2020). A Cluster-Based Route Design of Multi-Capacity Vehicle in Large-Scale Demand Responsive Transport Service for the Disabled. *99th Annual Meeting of the Transportation Research Board*, Washington, D.C., United States.
8. **Ka, E.**, Hong, D., Na, Y., and Lee, C. (2018). Analysis of Status in DRT Service for the Disabled in Seoul and Comparison Domestic and Foreign Cases. *International Conference for Road Engineers*, Jeju, South Korea.
7. Hong, D., **Ka, E.**, Ha, S., and Lee, C. (2018). Selection of Appropriate Hyperparameter for Waiting Time Prediction Model for Demand Responsive Transport for the Disabled in Seoul Using Long Short-Term Memory (LSTM) Network. *78th Korean Society of Transportation Conference*, Wonju, South Korea. **[Outstanding Paper Award]**.
6. **Ka, E.**, Ha, S., Hong, J., and Lee, C. (2017). Application of Deep Learning for Demand Forecasting of Call Taxi for the Handicapped in Seoul. *77th Korean Society of Transportation Conference*, Seoul, South Korea.

5. **Ka, E.**, Kim, S., Hong, J., and Lee, C. (2017). A Preliminary Study of Comparison with Lane Changing Model Parameters in Merging Area between Normal and Raining Conditions. *12th International Conference of Eastern Asia's Society for Transportation Studies (EASTS)*, Ho Chi Minh, Vietnam.
4. **Ka, E.**, Woo, D., and Lee, C. (2016). The Importance of Demand Prediction for Vehicle Relocation Strategy Development in One-way Car-sharing System. *3rd International Conference on Computational Science and Engineering*, Ho Chi Minh, Vietnam.
3. **Ka, E.**, Kim, S., Woo, D., and Lee, C. (2016). An Estimation of Critical Gap for Gap Acceptance Model Applied to Lane Change of Surrounding Vehicles in Driving Simulator. *2016 Fall Korea Institute of ITS Conference*, Jeju, South Korea.
2. **Ka, E.**, Lee, S., Lee, J., and Lee, C. (2016). Comparison of Survival Model of Traffic Flow Deterioration due to Traffic Accident according to VDS Aggregation Level. *75th Korean Society of Transportation Conference*, Busan, South Korea.
1. Lee, S., Lee, H., Lee, J., **Ka, E.**, and Lee, C. (2016). Analysis of Traffic Flow Impacts of Highway Traffic Accidents Using Survival Analysis. *74th Korean Society of Transportation Conference*, Jeju, South Korea. **[Outstanding Paper Award]**.

Awards, Fellowships, & Grants

GLITE Endowment fund Great Lakes District of Institute of Transportation Engineers (GLITE)	\$ 445	Apr, 2025
Honorable Mention, 2025 Clifford Spiegelman Student Paper Competition The Transportation Statistics Interest Group (TSIG) of the American Statistical Association (ASA)	\$ 250	Jan, 2025
2025 KOTAA Travel Grant Award Korean Transportation Association in America (KOTAA)	\$ 100	Jan, 2025
Travel Grant Purdue Graduate Student Government and the Graduate School	\$ 300	Dec, 2024
Student Paper Award ITE Indiana		Dec. 7, 2024
Kinnier Graduate Scholarship Lyles School of Civil and Construction Engineering, Purdue University	\$ 750	Oct. 4, 2024
STV Civil Engineering Graduate Assistantship Endowment Lyles School of Civil and Construction Engineering, Purdue University	\$ 500	Oct. 1, 2024
2024 KOTAA Travel Grant Award Korean Transportation Association in America (KOTAA)	\$ 200	Jan, 2024
Crooks Travel Scholarship Lyles School of Civil Engineering, Purdue University	\$ 500	Sep. 18, 2023
Outstanding Paper Award 78th Conference of Korean Society of Transportation, Korean Society of Transportation		Mar. 10, 2018
Lecture & Research Scholarship Dept. of Civil and Environmental Engineering, Seoul National University	\$ 4,500	Sep. 2016
Brain Korea 21 Plus Scholarship National Research Foundation of Korea	\$ 2,400	Mar. 2016
Need-based Scholarship Dept. of Civil and Environmental Engineering, Seoul National University	\$ 500	Mar. 01, 2016

Outstanding Paper Award*Feb. 19, 2016*

74th Conference of Korean Society of Transportation, Korean Society of Transportation

Alumni Association Scholarship*\$ 3,000 Oct. 25, 2015*

Alumni Association of Dept. of Civil Engineering, Seoul National University

Bronze Award*\$ 400 June 17, 2013*

6th Science and Technology Writing Excellent Research Paper Presentation Competition, College of Engineering, Seoul National University

Academic and Professional Activities

ACADEMIC SERVICE

- **Journal Referee:**

Transportation Research Part C: Emerging Technologies;
Transportation Research Interdisciplinary Perspectives;
Transportation Research Record: Journal of the Transportation Research Board;
Journal of Transportation Engineering, Part A: Systems;
Data Science for Transportation

- **Conference Referee :**

Transportation Research Board; IEEE Intelligent Transportation Systems Conference (ITSC); ISTTT26 (Co-reviewer) ISTTT25 (Co-reviewer)

PROFESSIONAL SERVICE

- **ITE Purdue Student Chapter:** Communications Director, 2024-25 ITE Executive Board Members

Skills

PROGRAMMING

- **Python (w/ TensorFlow, PyTorch, Keras, PySpark, and GeoPandas):** Machine learning and deep learning models based on TensorFlow, Pytorch, and Keras; Massive data (e.g., mobile phone location data) preprocessing for trip data extraction based on PySpark and GeoPandas
- **R:** Time-series analysis; Data preprocessing; Data clustering; Data visualization; Discrete choice modeling; and Statistical analysis
- **Java (w/ CPLEX):** Agent-based simulation (demand responsive transport services); Event-based simulation (one-way car-sharing services); Optimization models using the API of CPLEX

SOFTWARE

MATLAB(w/ Simulink), CPLEX, SPSS, NLOGIT, TransCAD, VISSIM, LaTeX, Windows, Linux (Ubuntu), and Mac OS