

Eunhan Ka

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

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Education

Purdue University

United States

PH.D., LYLES SCHOOL OF CIVIL AND CONSTRUCTION ENGINEERING

Aug. 2020 - present

- **Dissertation: Physics-Informed Neural Networks for Secure Connected and Autonomous Traffic Modeling** (Committee Members: Satish V. Ukkusuri, Ludovic Leclercq, Yiheng Feng, Z. Berkay Celik)

Seoul National University

South Korea

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** (Committee Members: Chungwon Lee, Dong-Kyu Kim, Seung-Young Kho)

Seoul National University

South Korea

B.S., DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING

Feb. 2016

Research Experience

Graduate Research Assistant

Aug. 2020 - Present

PURDUE UNIVERSITY

- Develop an innovative framework that strengthens road network resilience to cyber threats, minimizing potential disruptions and ensuring robust transportation system performance. (*Sponsor: USDOT*)
- Conduct a workforce development needs assessment to pinpoint critical skill gaps and implement targeted training strategies to bolster employee engagement and performance. (*Sponsor: INDOT*)
- Propose a novel methodology that integrates physics-informed deep learning into large-scale cyber-physical systems, enabling precise predictions of traffic states. (*Sponsor: USDOT*)
- Predict origin-destination (OD) matrices by using mobile location data (*Sponsor: INDOT*)
- Analyze the traffic impact of movable barrier on Vancouver's Alex Fraser Bridge 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 changing on freeways and gap acceptance behaviors at roundabouts in real situations and virtual reality (*Sponsor: Ministry of Land, Infrastructure and Transport, South Korea*)

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*)

Teaching & Mentoring Experience

Undergraduate Mentorship

Fall 2024 - Spring 2025

LYLES SCHOOL OF CIVIL AND CONSTRUCTION ENGINEERING, PURDUE UNIVERSITY

- Akshit Kumar Bedi, Abrar Ali (Poster, 2025 CERIAS Cybersecurity Symposium at Purdue University)

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

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

6. Ukkusuri, S. V.*, Hamim, O. F.*, Lei, Z.*, **Ka, E.***, Salek, M. S., Chowdhury, M., Amini, M. H., Cardenas, A., and Thuraisingham B. (2025). Cybersecurity for next-generation road transportation: A review. *ACM Journal on Autonomous Transportation Systems*. (*Contributed equally to this research).
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*, 189, 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.
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. **[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(1), 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(1), 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 paper in Refereed Journal Publications was 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. [**Out-standing 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]**.

BOOKS, CHAPTERS OF BOOKS

1. Hamim, O. F., Lei, Z., **Ka, E.**, and Ukkusuri, S. V. (in progress). Understanding Cyber Threats in Cyber-Physical Mobility Systems. *Advances in Transportation Cybersecurity and Resilience*, World Scientific Publishing.

Presentations

2. Needs and Gap Assessment of INDOT Workforce Development. *2025 Purdue Road School Transportation Conference and Expo*. March 18, 2025.
1. A Physics-Informed Machine Learning for Generalized Bathtub Model in Large-Scale Urban Networks. *TRB ACP50 Committee on Traffic Flow Theory and Characteristics (TFTC) General Webinar Series*. March 17, 2023.

Awards, Fellowships & Grants

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

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 74th Conference of Korean Society of Transportation, Korean Society of Transportation		Feb. 19, 2016
Alumni Association Scholarship Alumni Association of Dept. of Civil Engineering, Seoul National University	\$ 3,000	Oct. 25, 2015
Bronze Award 6th Science and Technology Writing Excellent Research Paper Presentation Competition, College of Engineering, Seoul National University	\$ 400	June 17, 2013

Academic and Professional Activities

ACADEMIC SERVICE

- **Journal Referee:** Transportation Research Part C: Emerging Technologies; Transportation Research Part F: Traffic Psychology and Behaviour Transportation Research Interdisciplinary Perspectives; The Journal of Supercomputing; Journal of Cloud Computing; 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

- **American Society of Civil Engineers (ASCE):** Associate Member (May, 2025 - Current); Student Member (Sep, 2022 - Apr, 2025)
- **Institute of Electrical and Electronics Engineers (IEEE):** Student Member (May, 2025 - Current); IEEE Intelligent Transportation Systems Society Student Member (May, 2025 - Current)
- **Institute for Operations Research and the Management Sciences (INFORMS):** Student Member (May, 2023 - Current)
- **ITE Purdue Student Chapter:** Communications Director (Aug, 2024 - July, 2025); Member (Aug, 2020 - Current)

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, LATEX

MATLAB(w/ Simulink), CPLEX, SPSS, NLOGIT, TransCAD, LaTeX/