

Hyunsoo Yun

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EDUCATION

Ph.D., Civil and Environmental Engineering

Seoul National University (Advisor: Prof. Dong-Kyu Kim)

Seoul, South Korea

Mar. 2020 – Feb. 2025

Dissertation: Real-Time System Optimal Route Guidance Considering Demand Uncertainty and Compliance Rate

B.S., Civil Engineering

Kyung Hee University

Yongin, South Korea

Mar. 2016 – Feb. 2020

RESEARCH INTERESTS

- **Transportation Planning:** Travel Demand Modeling, Network Modeling, Traffic Assignment
- **Methodological Focus:** Dynamic Programming, Reinforcement Learning, Generative Models, Causal Discovery

EXPERIENCE

Postdoctoral Research Associate, Purdue University

West Lafayette, IN, USA · Jun. 2026 – Present

- Digital Twin Lab, advised by Prof. Ziran Wang.

Postdoctoral Researcher, Seoul National University

Seoul, South Korea · Mar. 2025 – May 2026

- BK21 Program for InfraSPHERE; Institute of Construction & Environmental Engineering, advised by Prof. Dong-Kyu Kim.
- Fulfilling mandatory national service through a research-based alternative military service program.

Guest Lecturer, Ajou University

Suwon, South Korea · Mar. 2025 – Feb. 2026

- Transportation Network Theory
- Transportation Seminar III

Research Intern, Data Intelligence Team, Kakao Mobility

Seongnam, South Korea · Aug. 2021 – Nov. 2021

- Dynamic pricing and short-term demand prediction for shared mobility services, advised by Dr. Dominic Jungmin Kim.

PUBLICATIONS

Selected Research

- **Yun, H.**, Kim, E. J., Ham, S. W., & Kim, D. K. (2024). Navigating the Non-Compliance Effects on System Optimal Route Guidance Using Reinforcement Learning. *Transportation Research Part C: Emerging Technologies*.
- Lim, S. Y.[†], **Yun, H.**[†], Bansal, P., Kim, D. K., & Kim, E. J. (2026). A Large Language Model for Feasible and Diverse Population Synthesis. *Transportation Research Part C: Emerging Technologies*.
- **Yun, H.**[†], Lee, E.H.[†], Zhang, J., Wang, Z., & Kim, E. J. Neural-Bayesian structure learning for discrete choice modeling.(Under review in *Transportation Research Part B: Methodological*)

Other Publications

- Lee, S. H., **Yun, H.**, Ham, S. W., & Kim, D. K. (Accepted). Impact of Traffic Management Center Functionality on Speed Harmonization in Urban Networks under Mixed Traffic Environments. *Transportation Research Part A: Policy and Practice*.
- Kim, P., **Yun, H.**, & Kim, D. K. (2026). City-scale unmet bus demand modeling with passenger renegeing behavior. *Journal of Public Transportation*.
- **Yun, H.** & Lee, E. H. (2025). Party politics in transport policy with a large language model. *Transport Policy*.
- Kim, P., **Yun, H.**, Kim, J., & Kim, D. K. (2025). Scalable Link Cost Learning for Real-Time Route Guidance Systems. *Transportation Research Part C: Emerging Technologies*.
- Lee, E. H., **Yun, H.**, Cho, S. H., & Lee, E. (2025). Aggressive driving in ride-hailing: Work hours and road conditions. *Journal of Transportation Safety & Security*.
- Min, D., **Yun, H.**, Kim, D. K., & Ham, S. W. (2025). Dynamic Origin-Destination Matrix Estimation Using Metamodel-Based Model Predictive Control for Real Time Application. *Transportation Research Record*.
- Min, D., **Yun, H.**, Ham, S. W., & Kim, D. K. (2024). Real-time Estimation of Origin-Destination Matrices Using a Deep Neural Network for Digital Twins. *Transportation Research Record*.
- **Yun, H.**, Kim, E. J., Ham, S. W., & Kim, D. K. (2023). Price Incentive Strategy for the E-scooter Sharing Service Using Deep Reinforcement Learning. *Journal of Intelligent Transportation Systems*.

- **Yun, H.**, Lee, E. H., Moon, S., & Kim, D. K. (2023). Data-driven Approach for Measuring and Managing Physical Distancing in Subways During Pandemic Conditions. *Transportation Research Record*.
- **Yun, H.**, Lee, E. H., Kim, D. K., & Cho, S. H. (2021). Development of Estimating Methodology for Transit Accessibility Using Smart Card Data. *Transportation Research Record*.

Ongoing Works

- Kim, J.T., Yoon, G., Kim, D. K., & **Yun, H.** Gradient-Based Calibration of Volume Delay Functions in Static Traffic Assignment via Implicit Differentiation. (Under review in *IEEE Transactions on Intelligent Transportation Systems*)
- Kim, P., **Yun, H.**, & Kim, D. K. Learning Heterogeneous Link Costs for Scalable Real-Time Route Recommendation. (Under review in *Transportation Research Part E: Logistics and Transportation Review*)
- Lee, E. H., Cho, J. H., Tu, Z., & **Yun, H.** DeciGen: Generative Multi-Criteria Decision Making in Transportation Planning. (Under revision in *IEEE Transactions on Intelligent Transportation Systems*)
- Lee, E. H., Lee, E., Lee, Y.-I., **Yun, H.**, Yun, H.-R., Lee, G., & Lee, T. Fare-free Subway and Senior Delivery Work in Seoul. (Under revision in *Transportation Research Record*)
- Choi, S., Choi, J., Kim, D. K., & **Yun, H.** A Two-Stage Framework for Anomaly Detection and Classification in Loop Detector Data. (Under review in *Journal of Intelligent Transportation Systems*)
- Lee, E. H., Lee, J.-H., Kim, J., **Yun, H.**, Cho, S.-H., & Kwon, O. H. Functional Demand-Responsive Transit Planning for Older Adults in a Super-Aging Society Using Generative AI. (Under revision in *Transportation Research Part A: Policy and Practice*)
- Lee, E. H., Lee, E., **Yun, H.**, Cho, S.-H., & Souza, R. Prioritizing Road Drain Cleaning for Urban Flood Resilience in Seoul. (Under review in *Transportation Research Record*)
- Ahn, S., Kim, W., **Yun, H.**, Cho, S.-H., Soltani, A., & Lee, E. H. Morning Guard: Crossing Guard Effects in School Zones Using Vision AI. (Under review in *Transportation Research Record*)
- Zhang, J., **Yun, H.**, Deng, Z., Wei, C., Zhang, R., & Wang, Z. Mirrored Min-of-K Training. (To be submitted to the *IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR 2027)*)
- Jiang, L., Wei, C., Li, Y., Wang, S., Zhou, Y., **Yun, H.**, Liao, X., Pitts, B., & Wang, Z. InterSim: Innovative Intersection Digital Twins for Human-in-the-Loop Driving Simulation. (To be submitted to the *IEEE Internet of Things Journal*)

Book

- Qin, Z., **Yun, H.**, Li, R., Ji, A., Wu, G., & Sun, Z. Simulation, Digital Twins, and System Evaluation for Cooperative Driving. In *V2X-Enabled Cooperative Driving Systems*, Chapter 9. Springer Nature, forthcoming.
- Wei, C., Li, S., Peng, J., Wang, Y., **Yun, H.**, Zhou, H., Wang, Z., & Wu, G. V2X-Enabled Cooperative Driving: Deployment Experiences, Evaluation Protocols, and Future Directions. In *V2X-Enabled Cooperative Driving Systems*, Chapter 11. Springer Nature, forthcoming.

[†] These authors contributed equally as co-first authors.

CONFERENCES

- **Yun, H.**[†], Lee, E. H.[†], Zhang, J., Wang, Z., & Kim, E. J. (2027). Neural-Bayesian Structure Learning for Joint Causal Discovery and Discrete Choice Modeling. *TRB 106th Annual Meeting*. (Accepted for presentation)
- **Yun, H.**[†], Jiang, L.[†], Lu, J., Wei, C., McCoy, D., Ruble, T., Lintner, I., Reamer, D., Seely, C., Beck, J., & Wang, Z. (2027). Driver Comprehension and Behavior at Reduced Conflict Intersections: Evidence from Field Trajectories, Public Survey, and Driving Simulation. *TRB 106th Annual Meeting*. (Accepted for presentation)
- Lee, E. H., Lee, J.-H., Kim, J., **Yun, H.**, Cho, S.-H., & Kwon, O. H. (2027). Functional Demand-Responsive Transit Planning for Older Adults in a Super-Aging Society Using Generative AI. *TRB 106th Annual Meeting*. (Accepted for presentation)
- Lee, E. H., Lee, E., **Yun, H.**, Cho, S.-H., & Souza, R. (2027). Prioritizing Road Drain Cleaning for Urban Flood Resilience in Seoul. *TRB 106th Annual Meeting*. (Accepted for presentation)
- Ahn, S., Kim, W., **Yun, H.**, Cho, S.-H., Soltani, A., & Lee, E. H. (2027). Morning Guard: Crossing Guard Effects in School Zones Using Vision AI. *TRB 106th Annual Meeting*. (Accepted for presentation)
- Kim, J. T., Kim, D. K., & **Yun, H.** (2026). Network-Level Volume-Delay Function Parameter Calibration via Path-Based Proxy Gradients. *32nd ITS World Congress*.
- Choi, S., Choi, J., Kim, D. K., & **Yun, H.** (2026). Data-driven Identification of Incidents Affecting Traffic Flow under Faulty Sensor Data. *32nd ITS World Congress*.
- **Yun, H.**, Jiang, L., Zhang, J., & Wang, Z. Network-Wide Traffic Reconstruction Using a Generative Dynamic Traffic Assignment Framework (2026). *IEEE ITSC 2026 Workshop on Disruptive Technologies for Intelligent Urban Traffic Monitoring and Network Management*
- Lim, S. Y.[†], **Yun, H.**[†], Bansal, P., & Kim, E. J. A Large Language Model for Feasible and Diverse Population Synthesis. (2026). *TRB 105th Annual Meeting*

- Lee, E. H., Lee, E., Lee, Y.-I., **Yun, H.**, Yun, H.-R., Lee, G., & Lee, T. (2026). Fare-free Subway and Senior Delivery Work in Seoul. *TRB 105th Annual Meeting*
- Kim, J.T., Kim, D. K., & **Yun, H.** (2026). Gradient-Based Calibration of Volume Delay Functions in Static Traffic Assignment via Implicit Differentiation. *TRB 105th Annual Meeting*
- Lee, E.H., **Yun, H.**, & Tu, Z. (2026). A Generative Multi-Criteria Decision-Making Framework for Evaluating Transportation Systems: A Case Study of Texas. *TRB 105th Annual Meeting*
- **Yun, H.**, Kim, E. J., & Kim, D. K. (2025). The Potential of Large-Language Models as Regularizers in Deep Generative Models for Population Synthesis. *ITS Asia Pacific Forum*
- **Yun, H.**, Kim, D. J., & Kim, D. K. (2025). Managing Supply-Demand Imbalance in Shared Mobility Services Through Spatiotemporal Pricing. *Transportation Research Symposium 2025*
- Min, D., **Yun, H.**, Ham, S. W., & Kim, D. K. (2025). Real-time Dynamic Origin-Destination Matrix Estimation Using Metamodel-based Model Predictive Control. *TRB 104th Annual Meeting*
- Lee, S. H., Ham, S. W., **Yun, H.**, & Kim, D. K. (2025). Speed Harmonization Based on Multi-agent Reinforcement Learning for Mitigating Traffic Congestion under Mixed Traffic Environment. *TRB 104th Annual Meeting*
- Min, D., **Yun, H.**, Ham, S. W., & Kim, D. K. (2024). Real-time Estimation of Origin-Destination Matrices Using a Deep Neural Network for Digital Twins. *TRB 103rd Annual Meeting*
- **Yun, H.**, Lee, E. H., Moon, S., & Kim, D. K. (2023). Analysis of Subway Passenger's Physical Distancing Before and After the Outbreak of COVID-19. *TRB 102nd Annual Meeting*
- Min, D., **Yun, H.**, & Kim, D. K. (2023). Developing Lane-changing Strategy of Autonomous Vehicles Based on Deep Reinforcement Learning Using Long-range Information for Mitigating Traffic Congestion. *The 15th International Conference of EASTS*

† These authors contributed equally as co-first authors.

RESEARCH PROJECTS

Development of Selection Criteria for Residential Driveway Temporary Signals (Oct. 2026 – Present)

- Funded by the Indiana Department of Transportation (INDOT).
- Developing data-driven criteria for temporary traffic signal selection by combining driving simulation and field validation to improve work zone safety and efficiency.

Kinetic Energy, Risk, and the Relationship to Traffic Safety (Oct. 2026 – Present)

- Funded by the Indiana Department of Transportation (INDOT).
- Developing a kinetic energy-based crash risk index using probe vehicle speeds and vehicle mass estimates to support roadway safety screening.

Modular Chiplet structure-based Human-centered AI Foundation Models for Robust Scalable Automated Driving (Sep. 2026 – Present)

- Funded by the Korea Institute for Advancement of Technology (KIAT) through the Global Technology Industrial Cooperation Center program for international research collaboration.
- Developing a diffusion-based driving world model for driving scenario generation and risk estimation.

Understanding and Shaping Driver Behavior and Public Perception at Reduced Conflict Intersections (RCIs) (2026 – Present)

- Funded by the Indiana Department of Transportation (INDOT).
- Conducting driver surveys and field observations, including vehicle trajectory extraction from drone footage, to analyze driver behavior and public perception of RCIs.

Developing Imputation Methods for Missing Traffic Data (2021 – 2026)

- Funded by the Korean National Police Agency.
- Designed deep learning models (multimodal learning models and GAN) to impute missing traffic data.
- Models implemented in the traffic monitoring system of the Korean National Police Agency.

Modeling Urban Digital Twins for Testing Network Control Strategies (2022 – 2026)

- Funded by the National Research Foundation of Korea.
- Developed a framework to calibrate real-time traffic data for microscopic simulation.
- Designed control strategies including congestion pricing, routing, and speed harmonization.

Dynamic Modeling and Assignment in Traffic Networks (2022 – 2023)

- Selected as a principal investigator in a program funded by the National Research Foundation of Korea for doctoral students.
- Developed a dynamic traffic assignment model for mixed traffic of human-driven and automated vehicles.
- Designed real-time system optimal routing strategies.

Measuring Optimal Density of Shared E-scooter Systems (2021)

- Funded by Deer Corporation.
- Optimized the regional allocation of fleets and developed price incentive strategies to address supply-demand imbalance.

Urban Rail Network Planning (2020 – 2022)

- Funded by Gyeongsangnam-do Province.
- Participated in urban rail network projects, performed assignment and economic analysis for new transit lines.

HONORS AND AWARDS

- Best Paper Award (Scientific Paper), 32nd ITS World Congress. 2026
- Excellent Paper Award, Korean Society of Transportation. 2025, 2026
- Brain Korea 21 Future Innovative Talent. 2024
- Excellence Award, Smart City Hackathon, Seoul National University. 2023
- Brain Korea 21 Scholarship. 2023, 2024
- Best Paper Award for Technological Innovation, 15th International Conference of EASTS. 2023
- Excellent Paper Award, The Korea Institute of Intelligent Transportation Systems. 2021, 2022, 2023(2)
- Research Subsidies for Ph.D. Candidates, National Research Foundation of Korea. 2022
- Chang-Ho Park Scholarship, Korean Society of Transportation, 2022.

ACADEMIC SERVICES

- **Conference Reviewer:** Transportation Research Board; ITS World Congress; IEEE ITSC; AAAI.
- **Journal Reviewer:** Transportation Research Part C: Emerging Technologies; IEEE Transactions on Intelligent Transportation Systems; Transportation Research Record; Journal of Intelligent Transportation Systems; International Journal of Urban Sciences; Knowledge and Information Systems; Expert Systems; Transportation Research Interdisciplinary Perspectives; Scientific Reports; Engineering Applications of Artificial Intelligence.
- **Workshop Organizer:** Workshop on Internet of Things in Intelligent Transportation Systems, IEEE ITSC 2026.
- **Program Assistant:** NSF International Research Experiences for Students (IRES), 2024 – Present.

INVITED TALKS

- AI-Driven Approaches of Mobility Systems. *Kyungil University*, May 18, 2026
- Smart Mobility in Future Cities: Status and Vision. *Department of Civil and Environmental Engineering, Seoul National University*, May 12, 2026
- Introduction to Transportation Systems Design. *Department of Civil and Environmental Engineering, Seoul National University*, December 5, 2025
- Optimizing Departure Time Distributions under Staggered Work Hours for Congestion Mitigation. *Kakao Mobility*, November 25, 2025
- Real-time Routing for System Optimal Flows under Uncertainty. *Studio Galilei*, September 10, 2025
- A Reinforcement Learning Framework for Traffic Assignment. *Myongji University*, June 12, 2025
- Developing Urban Digital Twins as a Platform for Testing Network Control Strategies. *The Korean Society of Intelligent Transport Systems*, October 24, 2024
- Towards Real-Time Operation of System Optimal Route Guidance. *University of Seoul*, August 29, 2024
- System Optimal Assignment and User Non-compliance Effects. *National University of Singapore and Seoul National University*, June 5, 2024

REFERENCES

- **Prof. Ziran Wang**, Assistant Professor, Purdue University (Postdoctoral Advisor) — Email: ziran@purdue.edu
- **Prof. Dong-Kyu Kim**, Professor, Seoul National University (Ph.D. Advisor) — Email: dongkyukim@snu.ac.kr
- **Prof. Eui-Jin Kim**, Assistant Professor, Ajou University — Email: euijin@ajou.ac.kr