# Watcharapong Wongkaew

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## PROFESSIONAL SUMMARY

I am a first-class honors graduate in civil engineering from Chulalongkorn University. I am interested in Geography, Transportation Science, Urban Planning, and Artificial intelligence. I have three years of experience in data sciences and research, primarily in transportation science.

## EDUCATION

**12th Grade, STEM Concentration**                                                                          **March/2019**

Mahidol Wittayanusorn School, Salaya, Nakhon Pathom

- Study on applying GIS in evaluating and surveying areas that are at risk of flood in Nakhon Pathom, Thailand
- Study on environmental and physical issues caused by water hyacinth using drone and satellite images
- Bronze medalist in the International Geography Olympiad

**Bachelor's Degree in Civil Engineering, Transportation Engineering**                                 **June/2023**

Chulalongkorn University, Bangkok, Thailand

- **Finished as a first-class honors graduate**
- Acquired research apprenticeship at Chulalongkorn University Transportation Institute between 2021 - 2023
- Received TED Fund on AI news agency: researching de-biasing news
- President at Chulalongkorn University Model United Nations Club
- Researcher at Engineering Student Committee between 2020 – 2021 (ESC)
- Head of RTUS Ideathon Bangkok Transportation team: EU-led youth incubation program in urban development
- Dissertation on contemporary 4-Step-Transportation-Modeling of public transportation in Nakhon Ratchasima

## EXPERIENCE

**Researcher**                                                                          **April/2024 – (Current)**

Academic Division, Pheu Thai Party, Bangkok

- Analyze transportation data from the Household Travel Survey 2022, Ministry of Transport, generate insights and reports from the data, and design public transportation policy for the government of Thailand
- Plan bus routes and incentives for public transport mode shifting in Lad Krabang, Bangkok: Ministerial Grant
- Work on the data and policy infrastructures in the party using data from the government

**Research Associate**                                                     **July/2021 – September/2024 (Current)**

Chulalongkorn University Transportation Institute, Bangkok

- Support in analyzing motorcycle self-reported accident surveys: Chulalongkorn University | May 2022
- Coordinate workshops and lectures on the topic of Bangkok congestion charge, assist in workshops organization: Thailand Clean Mobility Program | GIZ | June - August 2022
- Research and report in transportation policy and planning areas with logistics and railway engineering focus: Strategic Agenda Team, Thailand Science Research and Innovation (TSRI) | 2022 – 2024
- Survey Don Mueang airport and review data on airport access and egress data collection. Also, analyze and supervise those collected airport egress data. Write and report the results in academic articles: Airports of Thailand | 2023
- Research and review law and strategic plans for climate-sensitive transportation planning in Thailand and work as a researcher in Chiang Mai and Khon Kaen, Report on results of surveys from the researchers, Cooperate with German (GIZ) team and review data sources and law for the team: UrbanAct Project, GIZ | 2023
  - Public transportation governance review in local area
  - Infrastructure planning and operation in local area
- Review laws and safety statistics, conduct focus groups, and analyze collected data about the motor-tricycle (Tuk-tuk) safety program. Write and report the results to the agency: Department of Land Transportation, DOT | 2023 – 2024
- Supervise garbage collection program and analyze garbage collection logistics data, environment-sensitive areas: Bangkok Garbage Improvement Project, Bangkok Metropolitan Administration | 2023
- Assist in organizing and working on pilot projects about informal transportation: VREF Living Lab | 2023 – 2024

**Researcher**                                          July/2023 – September/2024 (Current)
Advanced Railway Infrastructure, Innovation and Systems Engineering (ARIISE) Research Unit, Bangkok
Transportation Behavior Research Group, Chulalongkorn University
- Work on track geometry data, and analyze buckling modes of railway tracks from FEM data, and visualize the data
- Work on sustainable transportation, railway infrastructure resilient, and climate change adaptation
- Lead and ideate the independent project on public transportation cost and navigating public transportation in Thailand: No grant, Chulalongkorn University | 2024
- Review and model travel time/ delay on national highway using data from highway department: Highway Traffic Operation Center | 2023 – 2024
- Working on land use induced demand on public transportation in Bangkok: No grant, Chulalongkorn University | 2024

**Operations Intern**                                          May/2022 – August/2022
Toshiba Infrastructure Systems & Solutions Corporation, Tokyo (Online training)
- Model urban railway line operations in crew/ train scheduling with a real-world example, and results compared to operation are at 80% accuracy in BTS Monorail Yellow Line and BTS APM Gold line
- Run operation plans and create new operation curves in planned railway projects.

**Lecturer / Faculty advisor**                                          July/2020 – September/2024 (Current)
Mahidol Wittayanusorn School, Nakhon Pathom
- Create a syllabus and curriculum for the National Geography Olympiad
- Help the Department of Social Science with classwork, exam reader, and fieldwork
- Train students in Geography Olympiad courses: Geography Fieldwork and Human Geography

## SKILLS

**Transportation Engineering**: Four-step sequential modeling/ Modal split modeling/ Discrete Choice Modeling/ Travel behavior survey and analysis/ Data Collection Skills
**Transportation Planning:** Urban Planning/ Policy Planning/ Equity Analysis
**Railway Engineering**: Detection of railway defect/ Infrastructure management and life cycle design
**Data analysis and statistics**: Forecasting and time series analysis/ Statistical modeling and simulations
**R and Python Programming**
**Machine Learning & AI:** Traditional statistical modeling / Deep Learning and Neural Networks
**Geographical skills**: Qualitative fieldwork / Human Geography
**Project Management:** Stakeholder Engagement/ Coordination and project planning

## CERTIFICATIONS

- **Sustainable Transportation Networks and Streetscapes**, Johns Hopkins University – 2023
- **Transportation, Sustainable Buildings, Green Construction**, Johns Hopkins University – 2023
- **Sustainable Regional Principles, Planning and Transportation**, Johns Hopkins University – 2023
- **Sustainable Neighborhoods**, Johns Hopkins University – 2023
- **Technology and Innovative Entrepreneurship**, Stanford University – 2023
- **The Data Scientist's Toolbox**, Johns Hopkins University – 2023
- **Geographical Information Systems**, École Polytechnique Fédérale de Lausanne – 2023
- **Management of Urban Infrastructures**, École Polytechnique Fédérale de Lausanne – 2024
- **Introducing Cellular Automata**, Coursera – 2023
- **Summer Course: Future's City System for Resilient and Healthy City**, TU Delft – 2023
- **Bayesian Statistics Specialization - Inference, Time Series, Hierarchical Model,** UC Santa Cruz – 2024
- **Human Mobility in Future Cities Specialization,** University of Amsterdam and EIT Mobility – 2024
- **Qualitative Research Methods,** University of Amsterdam – 2024
- **Causal Inference,** Columbia University – 2024
- **Mathematics for Machine Learning,** Imperial College – 2024
- Supervised Machine Learning: Regression, IBM – 2024
- Neural Networks and Deep Learning, DeepLearning.AI – 2024

## AWARDS/RECOGNITIONS/VOLUNTEER WORK

- Volunteer as an academic tutor at Police Border School in Chumpon
- Volunteer in Environmental Conservation camp at the University Anurak CU club
- Finalist at AEON SDG Hackathon on the topic of Beyond Biodiversity on the topic of upcycling

- Finalist in Thailand Innovation Awards 2021: **On-demand ride application in urban area**
- Honorable mentions at GPSC Greenovation Startup Sandbox on the topic of **hydrogen buses**
- Honorable mentions at AWS Build on ASEAN on the topic of **tracking low CO2 emissions from delivery users**
- Honorable mentions at the German Embassy EV Hackathon on the topic of **Superblock problems**
- Honorable mentions at Last Mile Hackathon by EIT on the topic of **first-last mile problems** in Bangkok
- Honorable mentions and popular votes of Falling Walls Lab on the topic of **on-demand transportation**
- Third place at Environhack by the Ministry of Natural Resources and Environment on **motorcycle EV conversion**

## COURSEWORK: RESEARCH/TERM PAPER/TERM PROJECT

- **Prediction and validation of motorcycle drivers' behavior**: report on the motorcycle self-reported accident survey by running the LOGIT and PROBIT models. Statistics Method for Transportation Analysis | May 2022
- **Operation and Infrastructure of SRTET Red commuter railway:** report on surveys and additional operation information. Railway Transportation System | December 2022
- **Mumbai Urban Transportation Plan:** report on research of Mumbai urban transportation infrastructure. Urban Transportation Planning | December 2022
- **Impact of social media news on the usage and attitudes towards various public transportation modes**: conduct a survey and analysis within the university area and write a report. Travel Behavior Survey and Analysis | May 2023
- **Neural Networks Model to detect the defects on railway tracks:** AI for Engineering | December 2022

## ACADEMIC RESEARCH EXPERIENCE: ARTICLES/PRESENTATIONS/CONFERENCES

- **Integrating Digital Surface Model for Flood Risk Assessment of Railway Networks in Thailand:** First Author at the International Conference of Rail Transportation (ICRT 2024). The article was accepted at the conference and will be considered for publication in **Railway Engineering Science.**
- **Detection and classification of Buckling Failure Modes in Ballasted Railway Track, Case Study: Southern Thailand:** First Author in this article, which is still under review.
- **Challenges in Climate Action Planning and Implementation in Developing Countries: A Case Study of Low Carbon Urban Mobility Governance in Thailand:** Co-Author in Transportation Research Board Conference. The article is currently under review at the conference board.
- **Public Transport Accessibility Index for Bangkok and Its Application:** First Author in Transportation Research Board Conference. The article is currently under review at the conference board.
- **The Impact of Public Transportation Availability on Airport Passenger Egress Mode Choice: Don Mueang International Airport:** First author of the article on public transportation at Don Mueang Airport. The article is currently under review by the **Journal of Transportation Planning and Technology**
- **Using Travel Demand Survey Data to Predict Mode Shift and Identify Potential Transportation Hub by Machine Learning Techniques; Case Study: Bangkok,** First author of the article on Bangkok Travel Demand Survey, **In-review at Transportation Research Board**

## CURRENT WORKS

- *Railway Track Management Exposed to Extreme Events Using Machine Learning: A Case Study in Tropical Climate Regions of Thailand* : first author of a book Chapter in Elsevier's **"Artificial Intelligence for Railway Infrastructure"**
- Decomposition Analysis of Mode Choice from Travel Demand Surveys 2017-2022
- Transportation mode choice modelling in Nakhon Ratchasima
- Modeling likelihood of motorcycle accident from survey data
- Investigation of travel time on national highway using GPS data
- Investigating Bus Public Transport Reliability using Real-time GPS Data
- Land use and public transportation ridership analysis

## PUBLICATIONS

- W. Wongkaew, W. Muenyoksakul, K. Manachamni, T. Tangjarusritaratorn, and C. Ngamkhanong. **Risk Assessment of Railway Tracks in Floodplain Area using Digital Surface Model.** International Conference on Civil and Building Engineering Informatics 2023. Article published in proceedings
- Wongkaew, W., Muanyoksakul, W., Ngamkhanong, C. et al. **Data driven machine learning prognostics of buckling failure modes in ballasted railway track.** Discov Appl Sci 6, 212 (2024). https://doi.org/10.1007/s42452-024-05885-3

# SAMPLE WRITINGS

**Abstract: The Impact of Public Transportation Availability on Airport Passenger Egress Mode Choice: Don Mueang International Airport**

This study aims to identify the determinants influencing the choice of airport egress modes, such as private vehicles and public transport services, among inbound passengers at Don Mueang International Airport, Bangkok, Thailand. Given the airport's status as one of the busiest in the region, it offers a range of transport options for passengers. The research employs a multinomial logistic regression model to examine the relationship between passengers' socioeconomic characteristics, trip attributes, and their selected egress modes. The findings highlight that direct public transport services, which do not require transfers, are a viable option for airport egress. Additionally, the proximity of transport service points to the arrival hall exit and the access time are significant factors in mode selection. The study suggests enhancing public transport services by expanding direct service routes and improving accessibility. However, the study acknowledges limitations, such as the exclusion of uncontrollable factors like weather conditions, traffic congestion, and flight delays, which could affect mode choice behavior. Future research should consider these variables to provide a more comprehensive analysis.

**Abstract: Data-Driven Machine Learning Prognostics of Buckling Failure Modes in Ballasted Railway Track**

This study explores the development and application of a machine learning (ML) approach to predict buckling failure modes in ballasted railway tracks. With the growing demand for safer and more reliable railway systems, the ability to foresee and mitigate track failures is paramount. Our study focuses on harnessing advanced ML algorithms to analyze and interpret complex data sets, aiming to identify potential buckling failures before they occur. The methodology employed involves collecting extensive data from previous advanced numerical studies. Faced with the inadequacy of field data collection on track buckling and the limited availability of data related to track conditions, our study has relied on simulation data for insight and analysis. This data is then processed and analyzed using sophisticated ML models trained to recognize patterns and anomalies indicative of potential buckling failures. A novel aspect of our approach is the integration of environmental factors, acknowledging their significant influence on the likelihood of both snap-through and progressive buckling in railway tracks. We compare the effectiveness of various ML algorithms in accurately predicting these failure modes and evaluating their performance in simulated and real-world scenarios. The findings demonstrate the models' proficiency in identifying early signs of both snap-through and progressive buckling, leading to timely interventions. This capability not only improves railway safety but also aids in efficient maintenance scheduling and asset management. Additionally, a case study in Thailand's railway system demonstrates the model's effectiveness in predicting buckling failures under tropical environmental conditions. This paper contributes a novel perspective to the field of railway infrastructure maintenance. By providing a reliable method for predicting specific buckling failure modes, it paves the way for enhanced operational safety and efficiency in railway networks, particularly in the face of dynamic environmental conditions.

**Abstract: Using Travel Demand Survey Data to Predict Mode Shift and Identify Potential Transportation Hub by Machine Learning Techniques; Case Study: Bangkok**

Identifying potential hubs in transportation networks is crucial for understanding structure, dynamics, and efficient management. This study explores machine learning techniques such as decision trees, random forests, and neural networks to predict mode shift patterns and identify potential transportation hubs using travel demand survey data in Bangkok. The research comprises two parts: first, a comprehensive machine learning model is employed to analyze the data and develop predictive models for mode shift behavior by dataset obtained from travel demand surveys conducted by the Office of Transport and Traffic Policy and Planning in Bangkok Metropolitan Region. The results of the mode shift factor are mode before and after the COVID-19 pandemic (2020), age, and travel distance. Secondly, the study identifies demographics and compares potential locations for transportation hubs based on projected mode shift patterns predicted by those models. The most prominent demographic to shift is working-age females who live in a small household in non-house accommodation and who are still a student or work outside of the home. The study found some hidden transportation hubs from the new transportation line; by planning, the city can better accommodate its inhabitants' changing travel preferences and future population growth. Overall, this research demonstrates the potential of machine learning techniques in harnessing and diversifying travel demand survey data to predict mode shift behavior and identify optimal locations for transportation hubs. The findings provide valuable guidance for policymakers in Bangkok and other rapidly urbanizing cities striving to build efficient and sustainable transportation networks.

## <u>References & Articles upon request: Prof. Dr. Saksith Chalermpong</u>