

論文審査の要旨

(Summary of Dissertation Evaluation)

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| 博士の専攻分野の名称<br>(Degree)   | 博 士 ( 工 学 )        | 氏名<br>(Candidate<br>Name) | YAQIU LI (李 亜秋) |
| 学位授与の要件  | 学位規則第 4 条第①・ 2 項該当 |                           |                 |
| 論 文 題 目 (Title of Dissertation)<br>Road Traffic Safety Determinants and Interventions: Incorporating Multi-source Heterogeneities in Human Factors and Built Environments<br>(道路安全の決定要因と対策：人的要因と構築環境における多次元の異質性を考慮する)  |                    |                           |                 |
| 論文審査担当者 (The Dissertation Committee)<br>主 査 (Name of the Committee Chair) 教 授 馮 涛<br>審 査 委 員 (Name of the Committee Member) 教 授 藤原 章正<br>審 査 委 員 (Name of the Committee Member) 教 授 力石 真<br>審 査 委 員 (Name of the Committee Member) 教 授 Lee Hansoo<br>審 査 委 員 (Name of the Committee Member) 准教授 塚井 誠人  |                    |                           |                 |
| 〔論文審査の要旨〕 (Summary of the Dissertation Evaluation)<br>This dissertation delves into enhancements in road safety through reducing injury severity, crash frequency, and crash size, as well as implementing driver tracking systems. It involves a thorough analysis and modeling of road safety determinants and interventions strategies, incorporating multi-source heterogeneity, particularly from the perspectives of human factors and built environments. Based on these results, policy recommendations are proposed correspondingly. The research confirms the presence of temporal, seasonal, spatial, distributional and group heterogeneity within the complex road safety system, indicating that accounting for these variations can lead to more accurate estimations. It also recognizes that road crashes often lead to multiple outcomes with heterogeneities in their distributions, suggesting that jointly modeling the interdependencies among outcome variables and their determinants can provide a more comprehensive understanding of accident causation compared to independent models. Additionally, this dissertation also highlights the importance of employing behavior change strategies to mitigate road users' risks in this complex system considering heterogeneity between demographic groups, emphasizing the multifaceted approach needed to enhance road safety effectively.<br><br>The dissertation started with an introduction chapter (Chapter 1), followed by literature review (Chapter 2) and a chapter describing data and surveys (Chapter 3). |                    |                           |                 |

Chapter 4 investigated injury severity and its seasonal transferability and temporal instability based on a random parameter logit model with heterogeneity in means and variances (RPLMV) and three other models a fixed parameters multinomial logit model (MNL), a random parameter logit model (RPL), a random parameter logit model with heterogeneity in means (RPLM) based on rainy and dry seasons motorcycle crash data between 2015 and 2017.

Chapter 5 examines the spatial influence of built environment and climate characteristics on motorcycle crash frequency, using the data from 197 districts in Cambodia during 2019 as a case study. Spatial autocorrelation of motorcycle crash frequency and various built environment and climate characteristics was confirmed using Moran's Index. After checking the motorcycle crash frequency distribution, and the multicollinearity of these explanatory variables, different regression models were employed and compared to understand these relationships.

Chapter 6 emphasize the joint occurrence of various variables that can result in biased and incorrect parameter estimation by simultaneously analyzing the factors influencing both injury severity and crash size, using motorcycle as a case study. This approach further distinguishes itself by considering the interdependence between these two results utilizing a copula-based approach. Six models based on copulas were developed using the ordered logit model, which was designed to capture the ordinal nature of injury severity and crash size. By analyzing motorcycle crash data from 2016 in Cambodia, the Frank copula framework was identified as the most effective among the five approaches.

Chapter 7 examined the impact of nudge approach on driver's willingness to use driver tracking across different age, marital, and income groups. Survey data were collected from a sample of 1054 respondents throughout Japan in 2020. Together with the PLS-SEM model and multigroup analysis, the analysis identified the effectiveness of nudge approaches.

Chapter 8 finally concluded this dissertation from a systematic perspective. The study recommends improvements in stakeholder coordination, human resource management, public transport, infrastructure, and traffic law enforcement as managerial strategies to achieve sustainable transport goals, encompassing social, economic, and environmental dimensions. Future research recommendations were also provided.

As a result of the review, the author of this dissertation is deemed fully qualified to receive the degree of Doctor of Philosophy in Engineering.