別紙４

報告番号	※　　第　　号

主　論　文　の　要　旨

論文題目 Incorporating Heterogeneity in Route Choice Modeling: Methodology and Case Studies Using GPS Data

氏　　名 李　大韋（LI Dawei）

論　文　内　容　の　要　旨

This thesis focuses on the route choice behavior of car drivers. Modeling route choice is essential when modeling travel demand. In the macroscopic travel demand models, such as the classical four steps model, we only need apply the simple route choice models that assume the drivers are homogeneous. However, in the recent years, the activity-based travel demand models attract increasing attentions. Since these models are agent based, it becomes necessary and possible to incorporate heterogeneity in route choice modeling. Therefore, the main objective of this study is to explore the heterogeneity in route choice behavior. Particularly, in this thesis, we investigate the incorporations of three kinds of heterogeneity in route choice modeling: the heterogeneity in perceptions, the heterogeneity in processes and the heterogeneity in tastes.

Heterogeneity in perceptions allows travelers' different perceptions of the same observed route attributes. To consider the heterogeneity in perceptions, especially drivers' en-route experiences, a Bayesian network (BN) based model is proposed and applied in a small network of Beijing, China, with the GPS data collected by taxis. In this model, drivers' dynamic travel time perception process is described by the inference problem of BN. Heterogeneity in processes means that although the manifested path observations are the same, travelers' really choice processes will be different. To consider the heterogeneity in processes is in fact to consider the en-route choices. We propose a process-based method for analyzing dynamic route choice behavior. The dynamic choice process is defined as the sequence of choices during a trip, including the route choices (both pre-trip and en-route choices) and the choices of making a route choice again at every decision node. The model is estimated and compared with conventional models using probe vehicle data. The results confirm that drivers do not tend to make route choice decisions at all decision nodes. The probability of making an en-route choice is related to a driver's sensitivity to benefit and the cost of making the decision, which is positively correlated with distance to the origin and negative correlated with the spatial scale of the intersection at the decision node.

The differences of tastes on the same observed attributes are referred as heterogeneity in tastes. We at first explore the taste heterogeneity which is related to some observed attributes. Particularly, we explore the effect of familiarity on route choice behavior. Familiarity considered here is both individual and OD pair specific, different from previous researches which only consider the individual specific familiarity. Three methods are applied: class specific parameters, structured scale parameter and structured parameters of explanation variables. The effect of familiarity to O-D pairs on route choice behavior is proved to be statistically significant using the data collected in Toyota by private cars. The model with structured parameters of explanation variables has a better performance than the structured scale parameter model. It is found that drivers will be more easy affected by some unobserved factors and less sensitive to the count of intersections than free travel time when travel between more familiar OD pairs.

At last, we propose a multi-level mixed logit model to incorporate both observed and unobserved characteristics. In the proposed model, the taste coefficients are treated as random and structured as observed characteristics. Further, to deal with the panel data problem, random taste is divided to three components: traveler specific, O-D pair specific and choice situation specific. Models with various assumptions about heterogeneity are estimated and compared using the GPS data collected in Toyota. Beside some behavioral findings, empirical analysis suggests that, to enhance the performance of route choice models, it is more efficient to add more observed characteristics relating to travelers and O-D pairs than to increase the complexity of the specification. It is also proved that the incorporation of O-D pair specific unobserved taste heterogeneity can enhance the performance of a route choice model significantly.