【様式４】

“Technical Research and Development for Road Policy Quality Improvement” Study Summary

No.	Title	Principal Researcher
No.26－3	Integrated Transportation Demand Management System with Road Pricing and Intelligent Transport System in the Future Network of Tokyo Metropolitan Three Ring Expressways	Hitotsubashi Univ. Prof. Toshinori NEMOTO

In order to propose road pricing policies to make efficient use of the metropolitan expressway network even during high transportation demand period, we reviewed pricing theory, made pricing alternatives, and evaluated them with economic models and user equilibrium traffic assignment models.

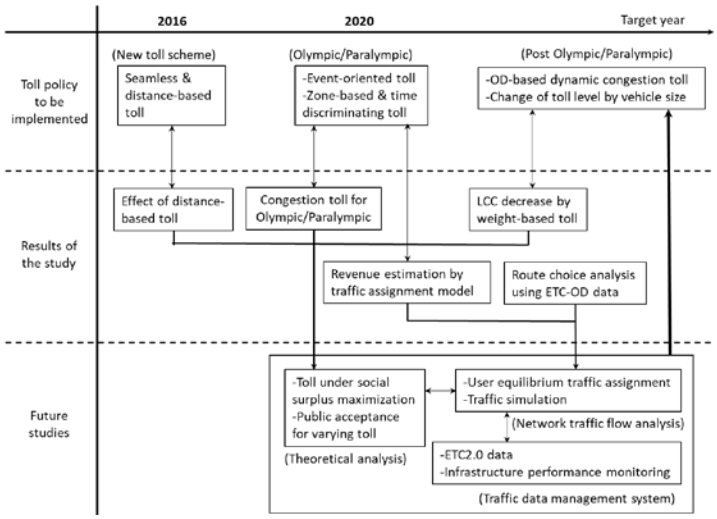
1. Backgrounds and Objects

In the Tokyo Metropolitan Area, three ring expressways will be almost completed so that road pricing policies are expected to make efficient use of the whole expressway network. In this study, we propose Integrated Transportation Management System by Pricing Policies, based on economic analysis to evaluate pricing policy alternatives and model development to simulate traffic in the Tokyo Metropolitan Area.

2. Activities in Research Period

【Study of Road Pricing Policy】

- Reviewing pricing theory and implementation process
- Analyzing distance-based pricing system on Shutoko from the viewpoint of social surplus
- Evaluating congestion charge on Shutoko during Tokyo Olympic/Paralympic and the decreasing population era
- Evaluating expressway toll based on vehicle weight in order to finance road maintenance and rehabilitation cost



【Study of ITS & TDM】

- To conduct analyses based on traffic engineering and transport planning approach in order to obtain basic information and knowledge on the design of future toll scheme after the completion of expressway development in the Tokyo Metropolitan Area.
- To propose a scenario to implement strategic toll scheme for Olympic/Paralympic Games, suitable traffic management scheme including appropriate toll setting after the completion of the network.

3. Study Results

【Study of Road Pricing Policy】

- We suggested that partially distance-based toll system (introduced at the beginning of 2012) and another new toll system, one almost completely distance-based (introduced in April 2016), increased the social surplus.
- We estimated social surplus assuming the traffic demand of current situation, and demand at the time of Tokyo Olympic/Paralympic and future de-population era. Then, we presented appropriate unit congestion pricing per distance is the same level as present unit ordinary toll per distance when Shutoko’s traffic demand is high.
- We confirmed theoretical validity of expressway toll based on vehicle weight. Then, this study found that the introduction of an expressway toll based on vehicle weight reduces total maintenance costs in

the two sections by shifting traffic from the ring road in the city center to the outer ring road in the suburbs, which is highly resistant to damage.

【Study of ITS & TDM】

-An analysis of the effect of toll scheme changes on traffic flow in the expressway network using traffic assignment analytical framework

・ It is found out that total toll revenue of the network by three companies increases or keeps its level in the case distance-based toll system is introduced in the whole network, and in the case unit distance toll in the central Tokyo area is increased. Then, the effectiveness of higher toll in the congested area is confirmed.

-An analysis of route choice behavior in the expressway network using ETC-OD trip chain data

・ It is observed that the Ken-o expressway which is the most outer ring has already been used as an alternative route, and route is mostly chosen by travel time information rather than toll level in the case there is few difference on utility among alternative routes.

Summarizing the results above, future direction of strategic toll implementation is proposed.

4. Papers for Presentation

1) Tetsuo SHIMIZU; "An Analysis of route choice behavior in expressway network ", The 12th Conference of Eastern Asia Society for Transportation Studies (Hochiminh,2017/9/18-21),(submitted)
2) OTAKI I., IMANISHI Y., MIYATAKE K., NEMOTO T., UCHIYAMA N. "Effects of the change of toll system on social surplus: A case study of distance-based toll in Tokyo Metropolitan Expressway," Transportation Research Procedia, Volume 25, 2017, Pages 2927–2937
3) 大瀧逸朗・今西芳一・内山直浩・**根本敏則**・宮武宏輔「首都高における混雑課金導入及び将来交通需要変動による余剰への影響分析」, 日本交通学会第 76 回研究報告会, 和歌山大学（和歌山市）, 2017/10,(submitted), (in Japanese)
4) WAKISHIMA H., MATSUI R., GOTO T., NEMOTO T. "Study of heavy vehicle toll management with ITS technology", The Proceedings of 23rd World Congress of Intelligent Transport System (Paper number ITS-AP-TP0213), 2016/10

5. Study Development and Future Issues

・ Determining zone-based and section-based basic toll derived by social surplus maximization concept
・ Study on time-discriminating toll system toward Olympic/Paralympic Games
・ Development of time-series traffic assignment model such as user equilibrium model and traffic simulation model
・ Determining suitable pricing level by vehicle size for strategic network facility renovation plan
・ Study on congestion pricing for transportation management assisting the strategic network facility renovation plan

6. Contribution to Road Policy Quality Improvement

・ We confirmed an importance of real-time traffic information for rout choice behavior through an analysis of route choice behavior in the expressway network using ETC-OD trip chain data. It suggests that congestion charge and, moreover, dynamic road pricing are effective in Tokyo Metropolitan Area.
・ We presented not only an increase of producer surplus, but also that of consumer surplus, by internalizing congestion externality. It suggests the possibility which the social acceptability of congestion charge can be enhanced. In addition to it, we provided some implications about road pricing policy through the evaluation of congestion charge at the time of Tokyo Olympics/Paralympics in 2020 and that of future decreasing population era.
・ We analyzed an induction effect from Shutoko to Ken-o expressway by introducing an expressway toll based on vehicle weight from the viewpoint of cost. Then, we indicate that it is appropriate to reduce LCC (Lifecycle Cost) by extending the life of road structures with pricing policies.

7. References, Websites, etc.

Nothing.