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

No.	Title	Principal Researcher
No.29－2	New evaluation methods for road stock aimed at spreading the autonomous driving system in diversified regions that actively interact with other regions	Tokyo Univ. Prof. Noboru Harata

The purpose of this study is to introduce and spread the autonomous driving system to flows of goods and people in the hilly and mountainous areas. It clarifies the function required for roadside stations as a small base in its region, and the road infrastructure coping with autonomous driving by implementing the pilot program for practicalizing the autonomous driving system based on roadside stations. Thereby it makes a draft of a development plan for road network coping with autonomous driving system and develops the evaluation model of the road plan and the data platform for evaluating road stock.

1. Backgrounds and Objects

Nowadays, there is a concern that the expansion of the blank areas with no public transportation service or no delivery service, because of the deteriorating business environment caused by the decline and ageing of the labour force in public transportation services or logistic companies. In the Grand Design of National Spatial Development towards 2050, as countermeasures against the progressive demographic shrinking, low fertility rate, and hyper-ageing society, it shows the necessity of geographical “compactification”, and "networking" to secure the population in the regions for maintaining the advanced urban function and for reconstructing the regional public transport network.

Today, the introduction of the autonomous driving technology which has been developing recently to “network” is regarded as one of the methods of resolution for the labour shortage. However, for the introduction of the technology, it needs a network design to solve problems to create an exclusive lane and effective routing considering the influence for the traffic condition combined general vehicles and autonomous vehicles, different from the conventional problem. The method for maximizing the road stock considering autonomous driving era has not been developed.

Aiming at introducing/spreading the autonomous driving system to flows of goods and people in the hilly and mountainous areas, we implemented pilot programs and surveys which assumed to conduct its service based on roadside stations. Thereby we clarified the function required for roadside stations as a small base in its region and the road infrastructure for autonomous driving. Then, we made a draft of an improvement plan for network coping with the autonomous driving system and developed the method of supporting the operation and evaluating for the introduction with the data from the survey and research. By sharing and using those data/methods among the evaluators for policy, the makers for transportation plan, its operators and its developers, the purpose of this study is to develop the regional mobility platform for next-generation to support/introduce the autonomous driving service.

2. Activities in Research Period

Theme 1: Development plan for road network coping with autonomous driving

In considering the development plan for road network coping with autonomous driving, we discussed the followings; basic surveys such as interviews with companies and review of the research and development trend about autonomous driving, research of the development of autonomous driving service at home and abroad, and strategies such as conditions for introducing the service to roadside stations or its surroundings. Thereby we developed the "Practical Guideline on Development Plan for Road Network coping with Autonomous Driving", as the basic data for considering the network construction over the country.

Theme 2: Evaluation method of the autonomous driving service

To develop the evaluation method of the autonomous driving service, we gathered data about the introduction effect evaluation/design of service/operating evaluation and developed an evaluation model. Then we developed the “Evaluation/Certification Guideline on Development Plan for Road Network coping with Autonomous Driving” for supporting the appropriate evaluation of investment effects and the profitability of the development plan.

Theme 3: Regional mobility platform for next generation

By sharing and using the data/methods among the evaluators for policy, the makers for transportation plan, its operators and its developers, we considered and constructed “Regional mobility platform for next-generation” to support

the introduction/spread of autonomous driving service.

3. Study Results

(1) Development plan for road network coping with autonomous driving

- Conducting the basic survey related to the trend in research/technology, the interview with companies, the reviews of existing research at home and abroad, and analysis/collection cases of projects for autonomous driving service at home and abroad. We collected efforts for the introduction/spread of the service.
- Based on the categories of service/areas introducing the autonomous driving service and the needs of user/operators, we considered the road condition required of the road network and strategy of road facilities, constructed “Guideline on Development Plan for Road Network coping with Autonomous Driving”

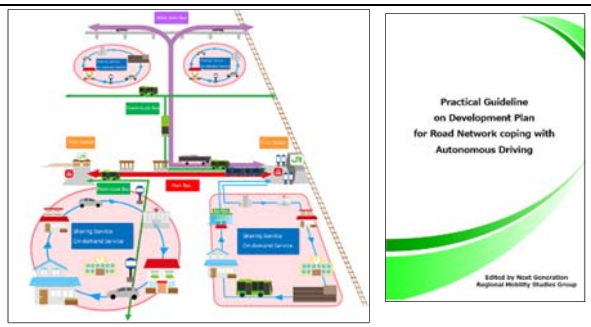

Figure: Practical Guideline on Development Plan for Road Network coping with Autonomous Driving

(2) Evaluation method of the autonomous driving service

- As the construction of the evaluation model, we considered and constructed the micro-simulation which is measurable of effect evaluation to transportation/urban activities and the method of the evaluation model for the transportation that contains both passenger and freight using the autonomous driving service.
- We discussed the process of evaluation/certification and its framework, thereby we considered its structure and contents, we constructed the “Evaluation/Certification Guideline on Development Plan for Road Network coping with Autonomous Driving”.

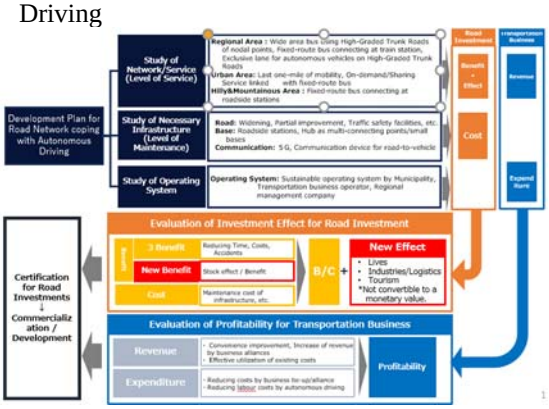

Figure: Framework of Evaluation/Certification for Road Network coping with Autonomous Driving

(3) Regional mobility platform for next generation

We developed “Regional mobility platform for next-generation” consisted of the date/platform as a basis of the evaluation for the transportation plan for next-generation, its data processing tools, the evaluation model of plan/design, service model.

4. Papers for Presentation

1. M.Chikaraishi, S.Fukuyama, H.Yamane, M.Sawa, E.Hato : Estimating willingness-to-pay for autonomous pickup services for agriculture products in ruralareas of Japan, ITS AP Forum, May 8-10, 2018.
2. M.Chikaraishi : (2018) Empirical estimation of temporal utility profiles under time-spaceprism constraints, Presented at the 15th International Conference on Travel Behaviour Research, Santa Barbara, CA, United States, July 16-19, 2018.
3. T.Fuse and N.Yokozawa : Development of a Change Detection Method with Low-Performance Point Cloud Data for Updating Three-Dimensional Road Maps, ISPRS International Journal of Geo-Information, Vol.6, No.12, 398, 2017.
4. S.Kurauchi :A Consideration on Passengers' Benefit Estimation Accrued by Expressway Expanrion in Shikoku Region, Traffic Enginering, Vol54,No.3,July, 2019.

5. Study Development and Future Issues

- Though this study presented for the consideration of plan, the framework about evaluation/certification, it needs to further discussion for the development of autonomous driving technology, regional characterizes, problems and future vision in practical applications. Thereby, it is desirable to be the plan which exhibits various stock effects for regions.
- In this study, we considered and developed the evaluation model for measuring typical effects. By further developing the evaluation model/data recorded on the platform, it is desirable to measure the effects/fields not covered in this study.

6. Contribution to Road Policy Quality Improvement

Through this research and development, we presented the method/approach of promoting the formation for road network coping with autonomous driving. About the above, we expect it contributes to the systematic development of Road investment required in future.

7. References, Websites, etc. [None]