

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

No.	Title	Principal Researcher
No. 30 - 4	Development of QOL-based Road Project Evaluation Methodology and Evaluation of Contribution to the SDGs	Chubu Univ. Prof. Yoshitsugu Hayashi

A methodology to evaluate road projects from the perspective of Quality of Life (QOL) based on various values including shopping, hospital visits, and tourism for working people, elderly people, and young people, going beyond the conventional cost-benefit analysis based on economic efficiency, and also a framework to comprehensively evaluate the contribution of road projects to the United Nations Sustainable Development Goals (SDGs) is developed.

#### 1. Backgrounds and Objects

In a multi-purpose, distributed-demand road-using society with an aging population and diversified lifestyles, it is essential to assess road policies by packaging methods that is able to evaluate different benefits for individuals with various needs, going beyond the conventional cost-benefit analysis that evaluate only economic value. This study develops a method to comprehensively evaluate the effects of various road projects (express way - streets, new construction - road space redistribution, etc.) from the perspective of various people.

#### 2. Activities in Research Period

This study developed and implemented a road project evaluation method based on QOL and an evaluation method for contributing to the SDGs by dividing the project into the following three themes.

##### Theme 1: Proposal of QOL Evaluation Indicators for Road Projects

Under this theme, the trends of road project evaluation methods and research in Europe, the U.S., and developing countries, and what is emphasized in the improvement effects of individual roads were compared and organized. The set of indices to evaluate the improvement of QOL brought by various road projects to users and residents along the roads were proposed. The QOL evaluation of transport projects was conducted using the values database constructed in Theme 2.

##### Theme 2: International comparison of values related to living environment and roadside environment

A questionnaire survey was conducted to quantitatively derive the values of residents and users for each of the indicators proposed in Theme 1, and a database of values for the living environment and roadside environment were constructed according to individual attributes, residential areas, and lifestyles. Through international comparisons of values in several countries around the world, future changes in values associated with economic growth in developing countries, the unique values in Japan, and the possibility of future changes in values were examined.

##### Theme 3: Development of an evaluation framework for the contribution of road project to the SDGs

Using the QOL-based road project evaluation method developed in Theme 1, a framework for evaluating the contribution to the SDGs, which are higher-level goals was developed, and verified the validity of the method for evaluating the SDGs based on the QOL concept.

### 3. Study Results

#### (1) Proposal of QOL evaluation indicator by road projects

Based on a survey of the existing literature on the benefits and effects of road development in various countries, a set of QOL evaluation indicator and structures were established, and the QOL indicator were proposed not only from the perspective of "economic and employment opportunities" and "life and cultural opportunities," which are expected to be directly affected by roads, but also from the perspective of "residential comfort," "safety and security," and "environmental friendliness. We also made proposals from the viewpoints of "residential comfort," "safety and security," and "environmental friendliness. In addition, indicators for subcategories for QOL evaluation, such as ease of driving and walking, were also set.

As a case study of the QOL accessibility method for transportation projects, we attempted to apply it to interregional highways, intercity bypass roads, and street reconstruction projects. It was shown that the multifaceted effects of road projects, such as higher-order medical care and tourism access for expressway projects, access to daily urban functions for bypass roads, and improved pedestrian walkability for street projects, can be expressed in a comprehensive framework without compromising the purpose and characteristics of each project.

In addition, a manual for the use of the proposed method has been developed.

#### (2) International comparison of values related to living environment and roadside environment

A questionnaire survey was conducted in six countries around the world to quantitatively derive the values of residents and users for the set QOL indicators, and because of the comparative analysis, differences in values according to personal attributes, region (country) of residence, and lifestyle were revealed.

#### (3) Construction of evaluation framework for contribution to SDGs by road project

In order to construct a method to strengthen the contribution to the SDGs by using the QOL accessibility method, 1) the relationship between the components of QOL and each SDG, 2) the relationship between access use value and SDGs, and 3) the relationship between cognitive value and SDGs were organized. The QOL accessibility method can be used to evaluate the contribution to the SDGs through the improvement of access to various opportunities by improving the convenience of transport. Through the case studies, it is highlighted that QOL accessibility method is also possible to evaluate the contribution to the SDGs by 1) region (SDG 10), 2) income level (SDG 1 to 3), gender (SDG 5), and so on by region and personal attributes.

### 4. Papers for Presentation

- Yoshitsugu Hayashi: QOL Value Accessibility Model for SDGs evaluation of transport and spatial development project – replacing conventional cost benefit analysis –, Keynote Lecture, 15th World Conference on Transport Research, 26–31 May 2019, Mumbai, India
- Noriyasu Kachi, Yoshitsugu Hayashi, Naoki Shibahara, Hiroyoshi Morita: Individual QOL Approach for Evaluation of Transport-Related Projects, ADBI High-Speed Rail Special Session (4) Modelling for Estimating Impact of Transport Infrastructure on Quality of Life, 15th World Conference on Transport Research, 26–31 May 2019, Mumbai, India
- Yoshitsugu Hayashi: QOL Accessibility Method for Project Evaluation –An Alternative Method to CBA to Cope with Diversified Values and SDGs–, Expressways and Automobiles 63(7), 6–10, 2020.07 (in Japanese)

### 5. Study Development and Future Issues

The QOL accessibility method proposed in this study is an evaluation method, which does

not preclude the use of predictive simulations of transport demand and land use that have been developed and advanced by transport engineering. The case studies conducted in this study all assumed changes in travel speed as a simple method, but if the traffic volume distribution models already used in practice are combined, it will be possible to conduct evaluations that consider the congestion mitigation and accident reduction effects of alternative routes. Furthermore, by combining the land use and location models, it will be possible to evaluate the effects on local employment, commuting, rent, and other indicators, which were not assumed to change in this study, making it possible to understand the effects of transport projects more comprehensively. This is also the case for street redevelopment projects, and although this study evaluates only the sub-model of pedestrian walkability for the sake of simplicity these projects are expected not only to improve spatial functions, but also to revitalize area commerce, enhance urban functions, and guide urban development. In fact, these projects are expected not only to improve spatial functions, but also to revitalize area commerce, enhance urban functions, and guide urban development. If the accumulation of knowledge on these effects increases, it will be possible to improve the quality of life in the region itself through improved access to urban functions, an increase in the number of residents, and even an increase in employment, making it possible to comprehensively evaluate the effects over the medium and long term.

In this study, a manual for practical use was developed, and we will promote it as a methodology that can be applied not only in Japan but also in future international cooperation and infrastructure exports.

#### 6. Contribution to Road Policy Quality Improvement

Cost-benefit analysis has long been used in the evaluation of transportation projects, especially domestic road projects, but for a long time only the three main benefits (travel time reduction, travel cost reduction, and traffic accident reduction) were subject to cost-benefit analysis due to the limitations of forecasting accuracy and practicality in the planning stage. However, nowadays, as the purpose of transportation projects is no longer limited to just speed and efficiency, various expansions of evaluation methods are being explored in various countries including Japan. The QOL evaluation method proposed in this study is a more comprehensive framework that can be used to analyze the various effects of transport projects, and it also allows the sense of values (time values) for each attribute. In addition, it is possible to calculate the effects of transport projects in detail by attribute and by factor. This method can also be applied to projects for which project evaluation methods have not yet been established, such as smart interchanges and road space redistribution. In addition, this method can be used to evaluate measures based on the environment of each district, such as the location of facilities and the attributes of residents, and can be used at the project planning stage to study various infrastructures and urban development related to the "Compact Plus Network" and their combination.

In addition, the evaluation includes an assessment of the contribution to the SDGs, which is highly useful in terms of publicizing the stance of road administration in Japan (e.g., road development that emphasizes fairness and inclusiveness among regions), and in terms of enabling future infrastructure exports to be negotiated with partner countries from an international perspective.

#### 7. References, Websites, etc. N/A