

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

No.	Title	Principal Researcher
No.27 - 1	A development of general and long-term evaluation of road reliability for Both Usual and unusual situations	Kanazawa Univ. Prof. Shoichiro Nakayama

For the sake of constructing the reliable road network, a general road benefit evaluation with both connectivity and travel time reliabilities has reached the stage of practical, and a method of road network design has been investigated. Methods of vulnerability assessment of road facilities and estimation of usual travel time variability application has been developed. Furthermore, a road network maintenance to ensure the long-term reliability has been examined.

### 1. Backgrounds and Objects

In Japan, the road network reliability is very important. In the usual case, travel time variability causes some disadvantage, and improvement of road reliability results in users' benefits.

Ensuring evacuation and transportation in the unusual cases is important, and active road links have to connect among disaster prevention bases. To investigate such connectivity reliability, hardware reliability of road facilities have to be considered.

In this study, a general road benefit evaluation with both connectivity and travel time reliabilities has reached the stage of practical, and a method of road network design has been investigated. Methods of vulnerability assessment of road facilities and estimation of usual travel time variability application has been developed. Furthermore, a road network maintenance to ensure the long-term reliability has been examined.

### 2. Activities in Research Period

Our research issues are followed:

- Risk evaluation of earthquake/landslide/flood hazards to emergency transportation roads
- Construction of a basic method of evaluating building disruption
- Development of management system of inspection date for bridge/tunnel/slope
- Elaboration of a general road benefit evaluation with both connectivity and travel time reliabilities
- Probe data analysis to grasp the travel time variability and development of its data complement method
- Development of a method to assess the road network connectivity using the eigenvalue analysis
- Connectivity analysis for the maintenance plan making

### 3. Study Results

The general road benefit evaluation method with both connectivity and travel time reliabilities has reached the stage of practical, and the method was applied to evaluate the road network in Ishikawa Prefecture, Japan. Using the probe data, the travel time variability of Route 8 in Ishikawa Prefecture was assessed, and the data complement method has been developed as a component technology. Furthermore, stochastic network equilibrium model was

improved to compute the travel time distribution of unobserved roads.

In this study, inspection data of bridges, tunnels and slopes have been collected, and their vulnerabilities are classified. Also, the management system of inspection date for bridges, tunnels and slopes was developed. For the small-scale road managers, its manual with free Q-GIS was prepared. Furthermore, the connectivity analysis of Chubu region road network was made.

#### 4. Papers for Presentation

Shutaro TSUBOKAWA, Keita WAKABAYASHI, Shun-ichi KOBAYASHI, and Shoichiro NAKAYAMA: TRIAGE OF IMPORTANT LINKS ON A ROAD NETWORK BASED ON THE ANALOGY OF A MASS-SPRING SYSTEM MECHANICS, Journal of Japan Society of Civil Engineers, Ser. A2, Vol. 74, No. 2, pp. I\_45-I\_54, 2018.

Hiomichi YAMAGUCHI, Kanako KOIZUMI, Shuji OSAWA and Shoichiro NAKAYAMA: PRIORITY RANK ESTIMATION OF DISASTER PREVENTION BASE FOR ROAD NETWORK RELIABILITY, Journal of Japan Society of Civil Engineers, Ser. D3, Vol. 74, No. 5, pp. I\_303-I\_314, 2018.

Takaaki NAKAMINAMI, Shoichiro NAKAYAMA, Shun-ichi KOBAYASHI and Hiromichi YAMAGUCHI: ULNERABILITY ASSESSMENT OF EMERGENCY TRANSPORTATION ROAD NETWORKS BASED ON EIGENVALUE ANALYSIS, Journal of Japan Society of Civil Engineers, Ser. D3, Vol. 74, No. 5, pp. I\_1141-I\_1148, 2018.

Shun-ichi KOBAYASHI, Keita WAKABAYASHI, Shutaro TSUBOKAWA and Shoichiro NAKAYAMA: STUDY ON A CHOICE OF HUB NODES IN A ROAD NETWORK AND ITS PARTITIONING BASED ON THE EXTENDED CONCEPT OF EIGENVECTOR CENTRALITY, Journal of Japan Society of Civil Engineers, Ser. D3, Vol. 74, No. 5, pp. I\_747-I\_760, 2018.

#### 5. Study Development and Future Issues

In the future, a method of estimate disaster occurrence probabilities should be investigated. Also, a method of merging probe and traffic counter data is required. Furthermore, parameter estimation of stochastic network equilibrium model with the probe or traffic counter data will be developed for more accurate assessment of travel time variability. The management system of inspection date for bridges, tunnels and slopes, it is improved and revised for its wide usage in a variety of road management situations.

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

It is useful for road managers to share their road facility data for the road network management and maintenance. Therefore, we continue to liaise the road managers in Ishikawa Prefecture, and share the road facility data among them. Furthermore, we try to distribute our developed methods and models to road managers in Ishikawa Prefecture to evaluate the connectivity analysis for emergency and to make an improvement plan of reliable road network.

#### 7. References, Websites, etc.

Our research reports will be opened on the web site of the Ministry of Land, Infrastructure Transport and Tourism, Japan.