Formation of Resilient Road Networks and Reallocation of Road Space

—Technology Policies for Road Infrastructure Based on Constant Monitoring and a Database—

TSUKADA Yukihiro
Director of the Road Department

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1. Internationally Competitive 21st Century Road Networks

The Committee on Formation and Operation of Expressways issued its interim report in December 2011, based on changes in social and economic conditions, medium- and long-term future prospects for Japan and for international society, and the experience of the Great East Japan Earthquake. The interim report outlined the functions of expressways—strengthening access to airports and ports, ensuring a service level of 60–80 km/hour between major cities and regions, and ensuring a network that will continue to function during disasters—in line with the basic principles: reorganizing and strengthening the national land in the face of population decline, and increasing people's trust in the national land. Noting that "If it's connected, it's a network!", it sets clear goals for improvements and management to eliminate missing links using easy-to-drive national highways and permanent two-lane expressways.

2. Completion of monitoring of road networks

In order to plan, improve, and manage such road networks which cover the national land, a system for constantly monitoring and managing the state of road traffic throughout the country is required. The road traffic census, which is an example of such monitoring, surveys the traffic volume and traveling speed on about 190,000 kilometers of trunk roads throughout Japan every five years, and its findings are used to plan road improvements. The 2010 census actively introduced automated surveys using constant traffic volume observation devices and portable traffic counters, made possible by ITS-based traffic measurements. Traveling data obtained by probe car systems operated by the private sector have also been widely used. Full-scale 24 hour/365 day road traffic monitoring has begun. Systems to monitor road traffic throughout Japan have only partly been established, but a large quantity of data which will be useful for enacting policies has already been obtained. As shown in Figure 1, as a result of population decline, the rise in the number of vehicles and vehicle kilometers traveled have both peaked, and are beginning to fall (average traffic volume down 2.6% from five years ago). In view of this reversal, we should clarify economic conditions, the effectiveness of countermeasures, impact of disasters, etc. using a continuous and high-density observation system. The results of traffic monitoring of high-standard road networks throughout Japan, which were continually observed from immediately after the Great East Japan Earthquake, were effectively used to set alternative routes and to enact emergency countermeasures for carrying people and materials to the disaster region. A trial by automakers, etc. to jointly collect private-sector probe data to publish viable routes on the web in real time was evaluated as extremely effective, and so efforts to integrate this with public probe data obtained by ITS Spots are expected. Figure 2 shows the state of congestion of the road network in the Tokyo region after the earthquake, obtained by analyzing probe data. It accurately reproduced and evaluated the state of congestion for the entire network and for each section, and will help clarify the condition of road networks spanning adjacent management regions when a disaster strikes, and can be used to prepare countermeasures.

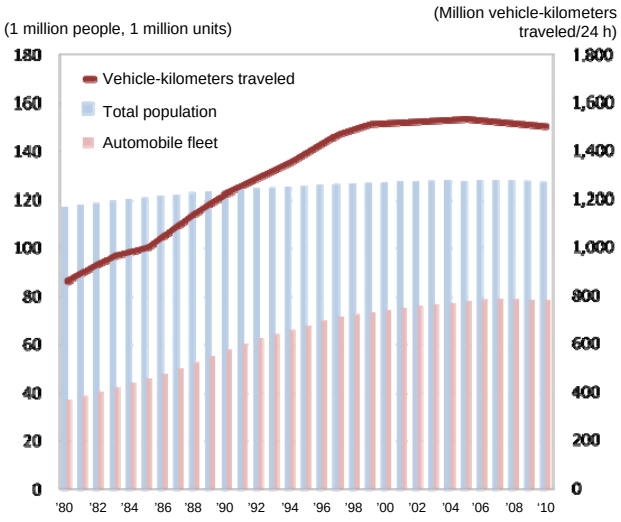
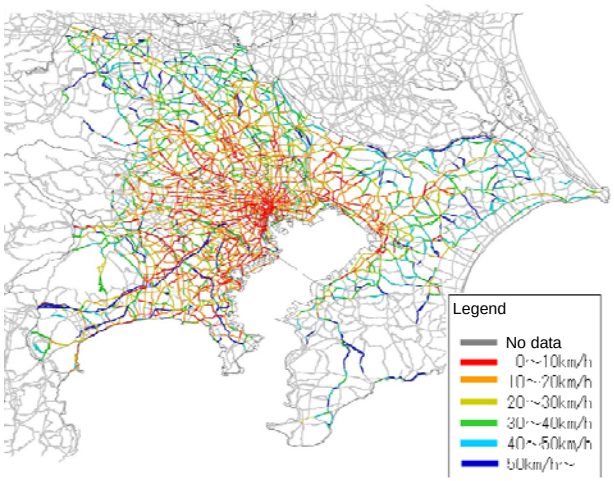


Figure 1. Changing population, automobile fleet, vehicle-kilometers traveled



Analysis of average traveling speed based on probe data
Declined sharply from 21.3 km/hr before the earthquake to 6.2 km/hr after

Figure 2. Reproduction of state of congestion in the Tokyo region after the Great East Japan Earthquake

3. Conservation of a resilient national land infrastructure and road assets

The interim report on the review of the Priority Project for Public Asset Improvement (November 2011) includes discussions of strategic maintenance and refurbishment management to deal with the deterioration of public assets under limited budget, and the development of technologies which will continue to function and withstand damage during disasters.

The NILIM is actively analyzing and surveying the damage to road structures following the earthquake, and has used the results to review the standards for road bridges, road earthworks, and other road structures. In addition to clarifying the mechanisms of damage to road structures by tsunami, the NILIM is also considering the need for design standards specifically considering the impacts of tsunami, and is defining earthquake resistance performance required for earthwork structures, which are part of the road network, to ensure that the roads can still be used after an earthquake, and intends to reflect the findings in technological standards. As the quantity of aged road assets increases, many cases of serious damage and accidents to bridges have been reported both inside and outside of Japan. Considering the declining population, falling birth rate, aging of society, and harsh financial conditions, the NILIM is now researching ways to maintain the functions of existing road structure assets as economically as possible, and creating new road structures with superior durability and reliability to minimize the burden of maintenance.

4. Reallocation of road space (creating environments for cyclists)

In Japan, as the trunk road network has been established, there have been discussions on changing the objective of road policy from “dealing with the growth in automobile traffic” to “coexistence of pedestrians, cyclists, and other road users”[2]. Specific measures now required include reallocating and effectively using limited road space, and placing priority on pedestrian and bicycle traffic along community roads.

Under such circumstances, while the number of traffic accidents is falling, bicycle related accidents have increased in the past 10 years, so it is necessary to prepare bicycle network plans and establish comprehensive rules for the design and use of safe and convenient bicycle spaces. The Ministry of Land, Infrastructure, Transport and Tourism and National Police Agency plan to draw up a guideline for these policies, which the NILIM is supporting by organizing network planning studies and gathering detailed technological knowledge on the structure of normal road sections and intersections.

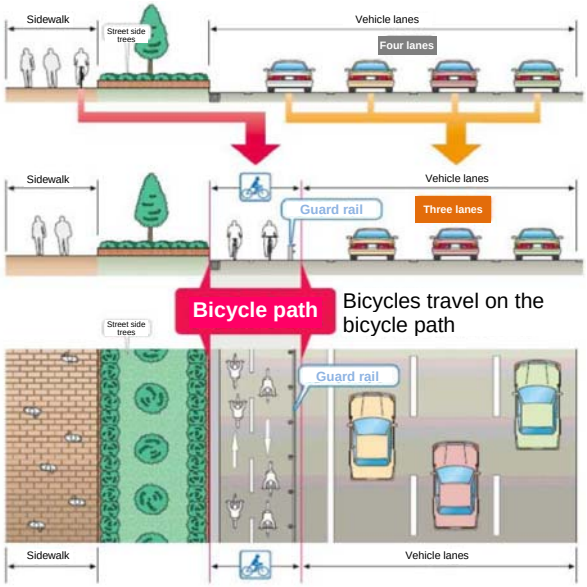


Figure 3. Model of bicycle traveling environment (Nagoya)[3]

References

1) Ministry of Land, Infrastructure, Transport and Tourism, Road Bureau: Interim Report of the Committee on Formation and Operation of Expressways, December 23, 2011.
2) Ministry of Land, Infrastructure, Transport and Tourism, Road Bureau: Interim report of the Council of Social Infrastructure, Road Committee, Basic Policy Subcommittee (Draft), February 7, 2012.
3) Document from the Chubu Regional Development Bureau of the Ministry of Land, Infrastructure, Transport and Tourism.