

NEW TOMEI LEADING-EDGE PROJECT: TOWARD THE "WORLD'S LEADING EXPRESSWAY SYSTEM"

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ABSTRACT

NEXCO-Central is currently building the New TOMEI Expressway that is a high-standard arterial road, reaching approximately 330 km in length. It connects Tokyo with Nagoya and is one of the pivotal expressway networks to better support future socio-economic activities in Japan.

By utilizing state-of-the-art technology and private sectors' expertise, NEXCO-Central aims at realizing the road traffic system that is the safest in the world, environmentally friendly, and easy to use while meeting a variety of needs from customers. In fact we are promoting "New TOMEI Leading-Edge Project (NTLP)", an unprecedentedly large-scale project, to fulfil our aspirations on the New TOMEI Expressway under construction.

The New TOMEI Expressway is expected to be "the leading expressway system in the world" in collaboration with "people", "vehicle" and "road". Also, it can maximize the role of expressway by improving the customer satisfaction as well as regional economy, and consequently leading to the overall development in Japan.

This paper describes the details of the NTLP such as its promotion system, customer needs' analysis, review processes to examine specific services, the outline and results of experiments, etc.

1. OUTLINE OF NEW TOMEI EXPRESSWAY PROJECT

New TOMEI Expressway Project is length of approximately 330 km of a new national expressway project between Tokyo and Nagoya in Japan. New TOMEI Expressway is

expected to form a new network along major big city of Tokyo, Nagoya, Osaka in Japan with New MEISHIN Expressway and to be a double expressway network with current TOMEI and MEISHIN Expressway as shown in Figure-1. Additionally, New TOMEI Expressway is expected to support and connect both "people" and "logistics" as a cardinal expressway network in Japan.

The New TOMEI Expressway has significantly fewer sharp curves, steep hills and wider shoulders than the current TOMEI and MEISHIN, designed it safer and more comfortable as shown in Figure-2. Meanwhile, a proportion of tunnels and bridges along the expressway are much more than current TOMEI Expressway because it is designed mountainside about 10km far from TOMEI Expressway.

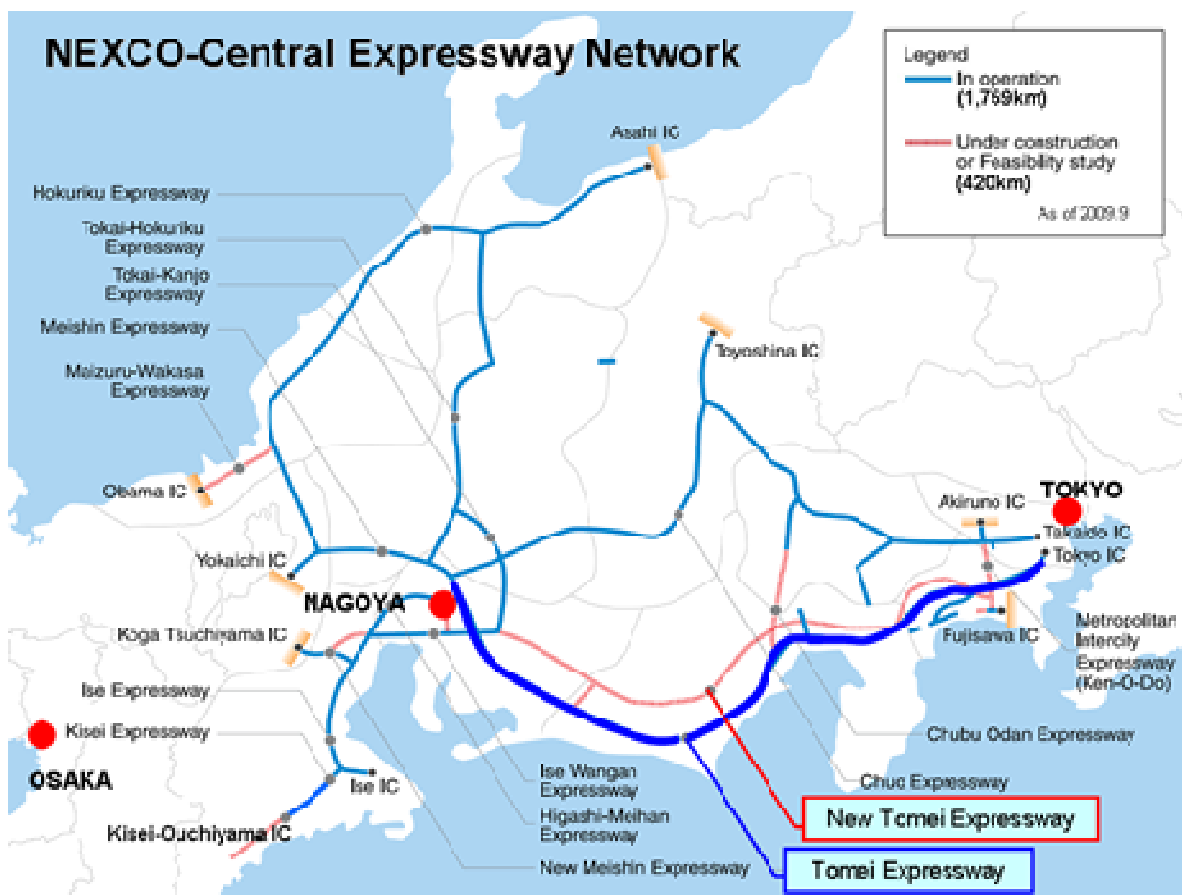


Figure-1 Location of New and Current TOMEI Expressway

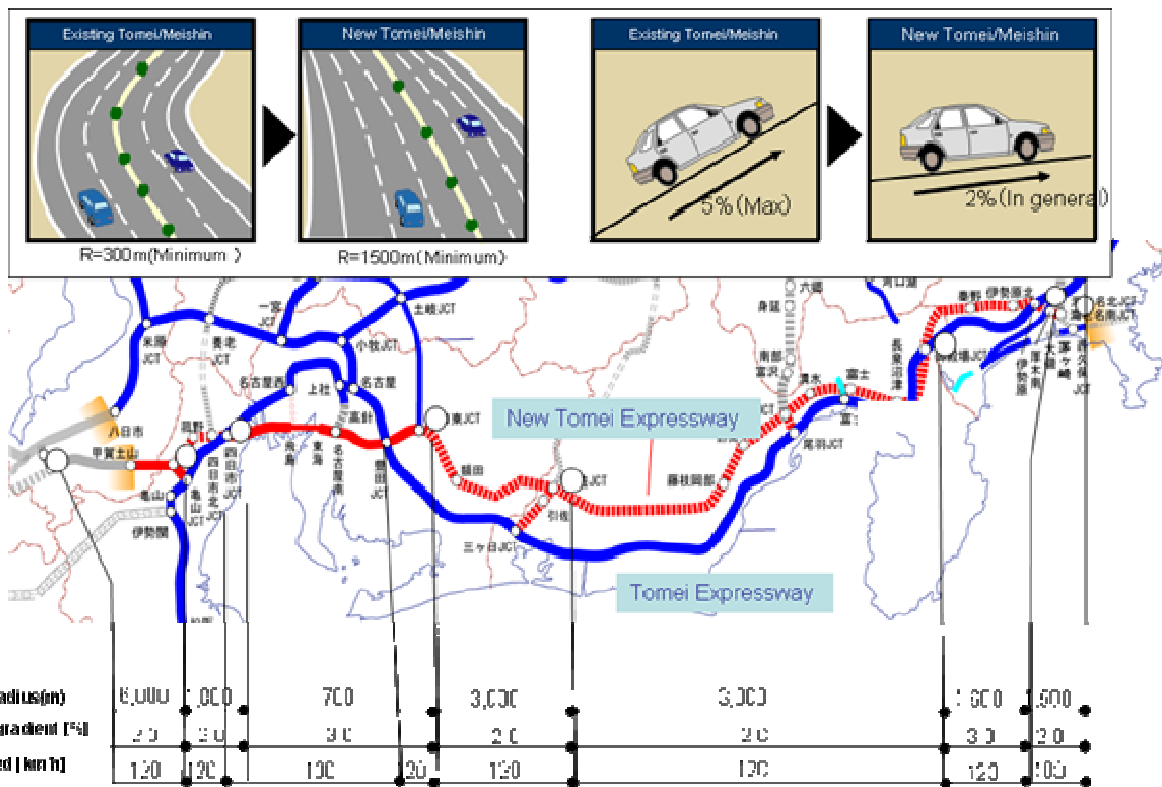


Figure-2 Characteristics of New TOMEI Expressway

2. WHAT IS NEW TOMEI EXPRESSWAY LEADING-EDGE PROJECT (NTLP)

While New TOMEI Expressway construction project has been progressing in recent years, supported by technological development of information and communication technologies (ICT), the services of Intelligent Transport Systems (ITS) such as Electronic Toll Collection systems (ETC) have been getting general service in Japan. The ITS is expected to provide various services such as support for safe driving, road management efficiency, commercial vehicles management efficiency and to have great success in New TOMEI Expressway. In addition, we are being asked to meet the expectations of the diverse needs of customers and services. We, NEXCO-Central, have a resolution that New TOMEI Expressway will be the “world's leading-edge expressway system” to collaborate with “people”, “vehicle” and “expressway” in order to respond customer needs and services, to improve a lifestyle, to activate regional area along the expressway and to contribute to the development of Japan through the “New TOMEI Leading-edge Project” (NTLP) as company-wide project.

3. SETTING DIRECTIONS AND AIMS FOR NTLP UNDER SOCIAL BACKGROUND

In the 21st century, social and economic conditions around the country such as the progress of aging and declining population, increasing severity of environmental problems, economic globalization, and emergence of regional disparities, has been greatly changed.

We think that it is necessary to promote sustainable development to deal adequately with these complex and diverse themes. Under such social background, we decided to focus on the following themes in NTLP.

3.1. Realization of Safety and Securities

In recent years, natural disasters, such as earthquakes, hurricanes, heavy rain and others, or some accidents and safety problems have been occurred frequently in the transport sector. Looking at the traffic accidents, both the numbers of traffic accidents and fatalities, have been decreasing in recent years. But there still seems to be a severe situation against traffic accidents and fatalities.

The NTLP aims to provide safety and security through the ensuring disaster emergency substitute, the function of diverse transport route and emergency evacuation, emergency assistance system, and support for safe driving assistance with ICT.

3.2. Consideration for the environment

The Kyoto Protocol entered into force and international efforts have been activated toward the post-Kyoto Protocol. As Japan proposed to reduce 50% of CO₂ by 2050, reduction of greenhouse gases has become important issue to any sectors on a global scale.

The NTLP aims to respond to various environmental issues through the ensuring smooth traffic flow, supporting energy conversion, developing maintenance facilities in harmony with the surrounding environment, and promoting preventive maintenance and other activities.

3.3. Realization of diverse lifestyles

To realize safe, secured and comfortable life has become a major challenge for everyone under such social condition of coming of era of population decline and aging society, the growing demands of the independent living assistance to people with disabilities, increasing the number of alien foreign tourists to Japan.

The NTLP aims to adapt to a variety of lifestyles through understandings of characteristics with people, creation of user-friendliness, providing various customer services at rest-areas and others.

3.4. Realization of a dynamic society

It is important to ensure smooth transportation in the country to realize prosperous and dynamic society under the economic globalization. Even though the total length of TOMEI and MEISHIN Expressway is only 7 percent in national expressways, the freight traffic on expressways shares about 33%. Therefore it is significant to support smooth and efficient

transportation on expressways. In addition, it is also important to solve the working conditions such as a driver shortage or working health and safety.

The NTLP aims to realize a dynamic society through the improvement of transportation system by ensuring smooth and efficient freight.

4. PROMOTION SYSTEM OF NTLP IN NEXCO-CENTRAL

In order to promote the NTLP, NEXCO-Central established as an external forum, called “New TOMEI Dream Road Forum”, to discuss direction of NTLP with some opinion leaders and some experts in various fields. On the other hand, Steering committee of NTLP led by board member was also established as an internal special committee with three working groups to arrange the internal and external project coordination. The Steering committee of NTLP consists 3 working groups: (a)Next-Generation Transport Systems Working Group, (b)Advanced Services and Maintenance Systems Working Group and (c) New Rest Area Development Project Working Group. Each group has led by executive officer addressed the division director to take action quickly reflected in the study results.

Additionally, "Operations Team of NTLP" is established with some company-wide staff consisting of several departments to coordinate the project in order to take quick response across the company. Since 2007, “New TOMEI Dream Road Forum” has been hold repeatedly six times and Steering committee of NTLP has been held 14 times so far.

5. ANALYSIS OF EXPECTATIONS TOWARD THE NEW TOMEI EXPRESSWAY AND NEW SERVICE

In order to realize the aim of the project direction of NTLP, some survey had been conducted to analyze some expectations from both customers and logistics companies for New TOMEI Expressway and new services.

A questionnaire survey, regarding the purpose of using the TOMEI Expressway, potential challenges to the TOMEI Expressway, hopefulness to the NEW TOMEI Expressway, expectations of new services after opening the New TOMEI Expressway and so on, was conducted with 1030 customers who were living along the TOMEI Expressway and used the TOMEI Expressway within a past year on the web. On the other hand, hearing survey was also conducted with 6 logistics companies by using similar questions as well as for the customers.

Some of the survey results to the customers are only reported below;

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5.1. Potential problems to the TOMEI Expressway and prospect for the NEW TOMEI Expressway

Approximately 82 percent of customers feel something dangerous because of a large numbers of trucks on the TOMEI Expressway. In particular, some problems such as "many accidents", "always congested", "dangerous at confluence and junction" and "difficulties of travel planning because of chronic congestion" have shown a high recognition rate.

Approximately 97 percent of customers feel significantly important that the New TOMEI Expressway should provide smoother traffic without congestions than the TOMEI Expressway.

Some items such as "various information service", "satisfaction for the rest areas" and "demand to use the shortest distance to the destination" to improve convenience and comfort and some prospects such as "non mixed traffic with trucks and vehicles" to improve safe and securities have shown a major rate of answers.

On the other hand, the futuristic prospect such as "automatic driving" or "availability for electric vehicle" on the expressway have shown relatively lower rate of trend.

5.2. Expectations for new services on the New TOMEI Expressway

As a result of three services selected by customers in order of priority from multiple candidates that will be provided on the New TOMEI Expressway, more than 60 percent of expectations have shown in that result of services such as "real-time information provision service" and "warning information provisioning service".

Two new services such as "Information service to approaching vehicle at the confluence and junction" and "various information services" show over 35 percent in the expectations. The expectations for information provisioning service show as high priority because that "information service at confluence and junction" is ranked as second and "various information services" is ranked as third.

6. PROCESS FOR THE ACCOMPLISHMENT OF THE NEW TOMEI LEADING PROJECT

The scheduled completion of the New TOMEI Expressway is drawing near. The sections between Gotenba and Inasa in Shizuoka Prefecture, in particular, are set to open in 2012. With some work yet to be completed, such as finishing pavement and facility works, there is not much time on our hands.

To ensure the successful, timely completion of the construction project of the New TOMEI Expressway, NEXCO-Central is taking various approaches from Year 2008 to 2012 as the Phase One of the New TOMEI Leading-Edge Project. These are some examples we have been undertaking to address possible issues before establishing the system design.

6.1. Field Tests

We have been conducting some field tests using the already completed sections of the New TOMEI Expressway to demonstrate the existing technologies, find solutions for technical problems and reflect the results back to new technological developments, particularly in the fields of construction, maintenance, traffic management, ICT and environment. We also aim to gain better public understanding for our project through widely publishing the information about the tests, opening the test sites to local communities and inviting local residents to drive on the test courses.

6.2. Partnership with External Organizations

To reflect the latest information and expert input from the relevant industries, we work with other private companies, research institutes and organizations.

6.3. Cooperation with Relevant Authorities

We cooperate and make necessary arrangements with relevant authorities and local governments for a smooth implementation of the projects. For example, we share information with them to secure the public safety, comply with relevant national or municipal policies, or learn from the outcome of other projects from the past.

6.4. Analysis of the Current Logistics System and Feasibility of New Expressway Services

With the opening of the New TOMEI Expressway, we hope to provide more efficient and smoother flow of freight transportation in Japan. To this end, we need to have an accurate understanding of how goods are currently transported via expressways and examine the feasibility of new services we will be providing on the New TOMEI. As part of this process, we are examining how our expressway services will change the logistic flow, where the current and the planned logistic hubs are located, and what the flow of reverse logistics is going to be.

6.5. Offering of Information to the Public

We constantly offer latest update on the project to the public in the hope of raising awareness of our project details, objectives and benefits. To maximize the effect of this

effort, we regularly open various field tests to the public and present the information in a simple and straightforward format.

7. DETAILS OF FIELD TESTS AND DEMONSTRATIONS

NEXCO-Central aims to examine the technological feasibilities and offer information to customers by conducting necessary field tests and demonstrations as part of the phase one of the New TOMEI Leading Project.

7.1. Selecting of items to test or demonstrate

We have asked our employees and our group companies to send in proposals on items to go through field tests or demonstrations, and received proposals of as many as 100 or more. The Operations Team of NTLP has evaluated the necessity and the prospects of the proposed items, and later the Steering committee of NTLP has decided on 78 items to go through field tests or demonstrations.

Out of these 78 items, we have decided to conduct a field test on the New TOMEI Expressway on 18 items listed in Table-1. For the rest of the items, we will be conducting demonstrations on 41 items while we collect further information and present the items in a panel.

Table-1 Proposed items for field test

Objectives and target		Approach	Examples of items to study
Improvement of safety and security	Reduction of accidents and congestions - to identify an incident on road at the earliest possible timing, directly inform/alert customers in a simple format => alleviation of traffic congestion, prevention of accidents	Help better understanding of traffic conditions	<Offering of higher standard of services via onboard ITS unit> - New services to provide in time for the full-fledged implementation of the Smart Way initiative - Warning system using onboard unit - Advanced CCTV camera - Emergency alert through simplified information board
		Provide detailed and latest information	- Route choice information on the multi-color LED signboard (graphic information board) - Seamless broadcast of the Highway Radio to provide detailed, up-to-the minute information on accidents, emergencies or route choices ahead
	Enhancement of road safety - to minimize the time of lane closures by improving and streamlining maintenance technologies => reduction of inconveniences to customers, reduction of lifecycle cost	Achieve longer service life of road	- Waterproofing of newly constructed floor slabs to save repair costs
		Improve the efficiency of road maintenance work	- Development of the new technology of a vehicle designed to automatically pick up obstacles on road
		Upgrade the system in toll plaza	- Automatic or remote toll collection system for higher efficiency
		Provide greater driving comfort	- Development of new type of signboard - LED-equipped delineator for safer and more comfortable entry into tunnel - Development of new tunnel lighting for greater driving comfort, lower cost, smaller environmental load and more efficient maintenance
	Global warming countermeasures - reduction of CO2 emissions and environmental load	Prevent global warming	- Usage of solar panels, fuel batteries and pellet boilers at rest areas - Use of multiple technologies in combination for highest efficiency - Possible effects - Charge stations and other infrastructures to prepare for the wider usage of electric vehicles in the future
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	Creation of comfortable space - improve and enhance the services provided at rest areas for greater comfort for customers	Create comfortable rest areas	- Universally user-friendly toilets (for the elderly, the disabled, foreigners, women, etc.)

8. CONDUCTING FIELD TESTS

We have developed test courses, as shown in Figuar-3, to conduct field tests on 18 items as mentioned earlier, using a newly constructed, but yet-to-be-opened section of the New TOMEI Expressway. The test courses replicate what the new expressway would look like after the opening and we can actually drive in this space for a test purpose.

To allow us to conduct various types of tests on expressways, we have created two test courses; one is a 9km stretch of embankment and bridges, and the other is an 8kn stretch of tunnels.

Both test courses have a test centre; all test data are gathered here, and we show demonstrations and display panels to exhibit some of the new technologies. We also use this test centre as a place to get feedback from academics, commercial researchers and the general public, both local and international.



Figure-4 Outline of a Test Course

8.1. Field tests for “creation of comfortable space”

18 items have been tested in the test courses. Now, we would like to outline the results of one of the tests already conducted on the topic of the “creation of comfortable space” as shown in Table-1.

As shown in Figure-4, Questionnaire survey and discussions with various people, especially foreigners who visit the test course and live around the experimental centre, have been conducted at a real rest room located in the course to verify the level of understandings of information signs (symbols). An information sign (symbols) consists of two types. One is international sign (symbol); another is domestic signs (symbols) as shown in Figure-5.



Figure4- Conditions of Information Signs at the site

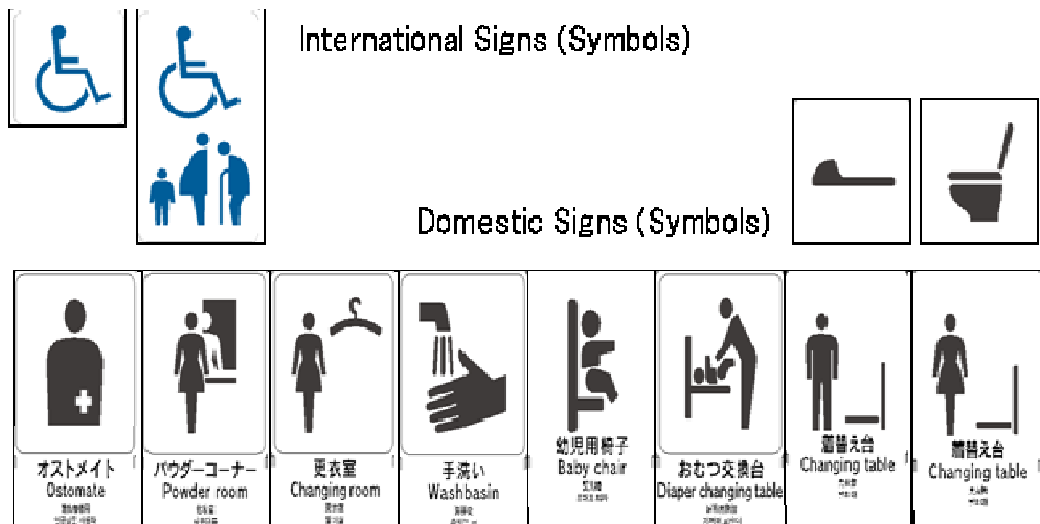
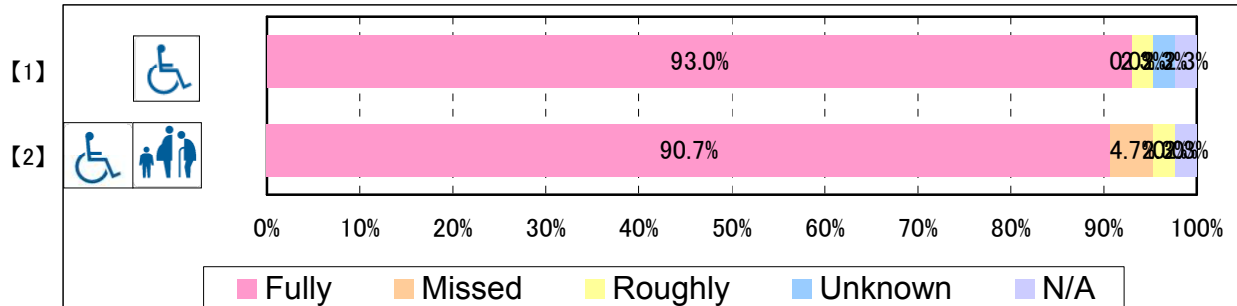


Figure-5 Types of Information Signs (Symbols)

While a high level of understandings is acquired to international signs, the domestic signs are NOT fully understood as shown in Figure-6

Group A: International Symbols



Group B: Domestic Symbols

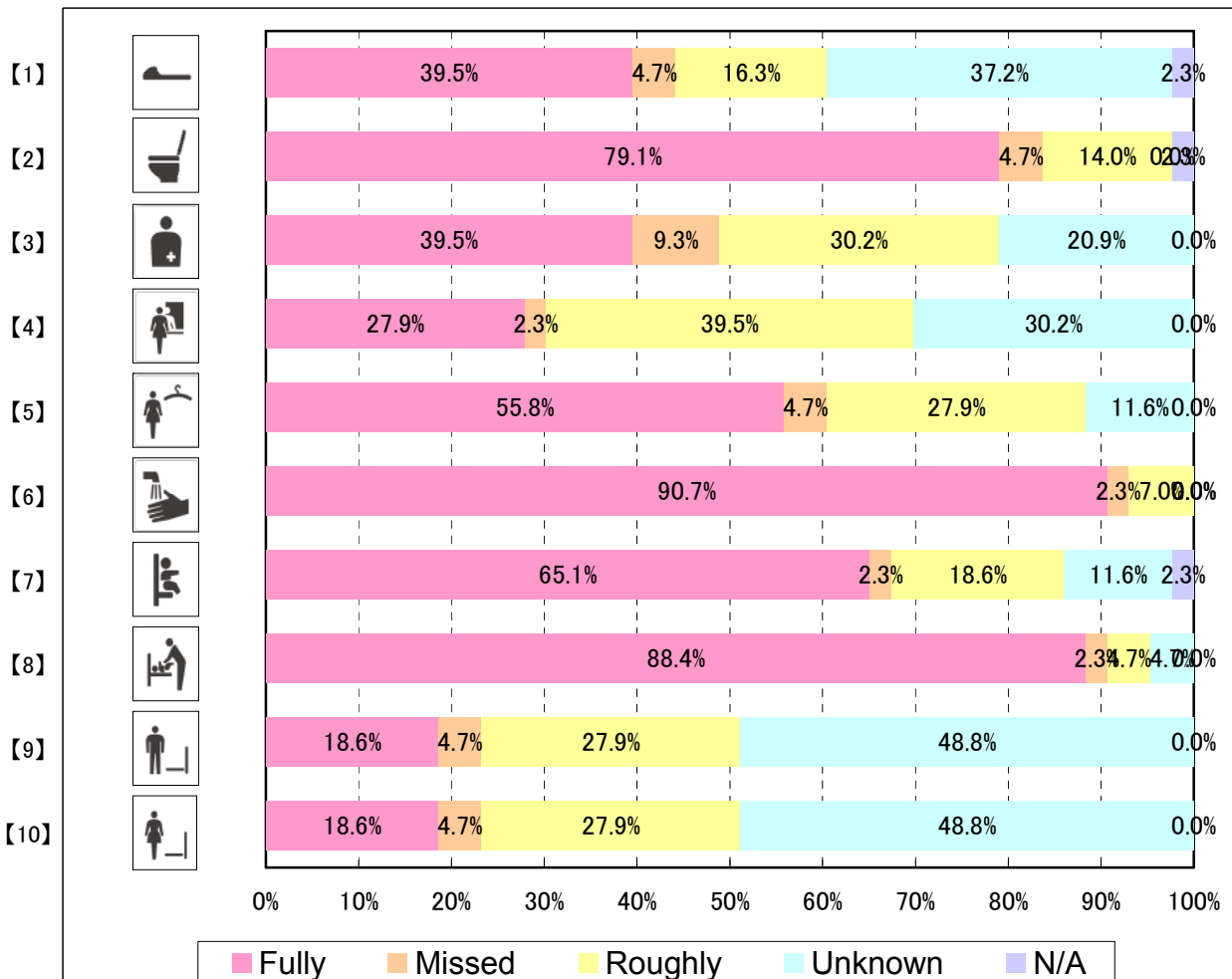


Figure-6 Understandings of Information Signs

Four kinds of sign such as Japanese style toilet, facilities for ostomate who has had an ostomy, powder corner where is for making and fitting board to change dressing is lower level of understandings than others even though

9. FEEDBACK FROM FIELD TESTS

It was possible not only to verify a technical verification through the result of 18 items of filed test at test course, but also to receive customers' opinions and the proposal widely through 19 items of panel exhibition and 41 items of demonstration there.

A result of field test is reported to the Steering Committee of NTLP through the check by the Operations Team of NTLP. At the Steering Committee of NTLP, overall viewpoint like not only technical issues but also economic issues and acceptability from the society will be discussed thoroughly.

The feedback from filed test will be instantly reflected into the construction site of the New TOMEI Expressway. Thus the content of service and the specification will be reviewed at any time as shown in Figure-7.

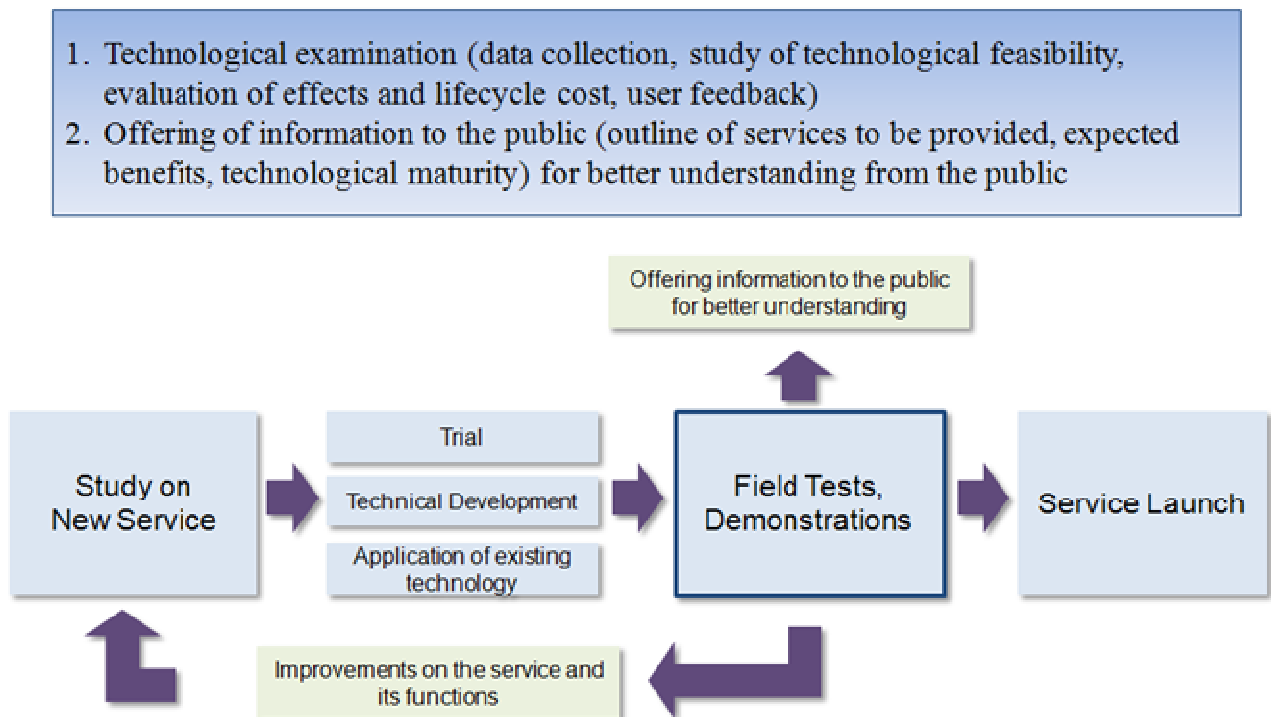


Figure-7 PDCA activities in NTLP

10. CONCLUSION

Since its opening in May 1969, the TOMEI Expressway has been serving as a nation's artery that enables a smooth flow of people and goods, making a great contribution to the socioeconomic development in Japan. On the other hand, this expressway constantly

experiences traffic congestion, which endangers the speed and travel time reliability of the expressway. Further, due to the aging of this expressway, some major repairs are required. In order to minimize the effects it would have on the public during the period of major repair works, and to secure a smooth flow of traffic even in times of accidents and emergencies, we are increasingly required to provide an alternative route in case the existing TOMEI Expressway fails. Against such backdrop, we have been working on the construction of the New TOMEI Expressway that runs parallel to the TOMEI Expressway.

The New TOMEI Expressway, together with the New MEISHIN Expressway, running from the Tokyo area, Central Japan, through to Western Japan, would form a critical network to support the nation's industries, cultures and economy, and its earliest opening is called for.

Besides the construction of a new expressway, the development of the Intelligent Transport System, or ITS has experienced striking progress. As the information technology develops, the technologies for car navigation systems, Vehicle Information and Communication Systems (VICS), Electric Toll Collection (ETC) systems, among others, have been improving every day. ITS is expected to secure higher driving safety, bring higher efficiency to the road management and improve the operations of freight trucks and other commercial vehicles. Some of the latest ITS technologies will be implemented in the New TOMEI Expressway to bring numerous benefits to the public and the nation.

NEXCO-Central believes it is important to contribute to the society with our New TOMEI Expressway, by providing new services that would satisfy social needs. As part of this process, we have established the basic strategies for the implementation of new services in the New TOMEI Expressway, after a series of discussion both internally and externally on services to provide on this new expressway.

There are various issues to overcome before we can put proposed new services into operation, for example, further technological or system improvements are required, some of which presents an enormous challenge. However, we are confident that, by conducting field tests and demonstrations, we will be able to find solutions to such issues. In doing so, we can make a great contribution to Japan's sustainable development into the future, providing safe and security to the public, minimizing the environmental load, and creating a vibrant society. To allow us to achieve this goal for the greater good, we would like to ask for the public's understanding, other companies and research institutes' participations in the project, and the help of national government or local communities, so we will be able to open the New TOMEI Expressway at the earliest possible date to provide numerous benefits.