Chapter 10 Utilizing ICT and Promoting Technology Research and Development

Section 1 Promoting Innovation in the Fields of Land, Infrastructure, Transport, and Tourism Through the Use of ICT

Information technology initiatives in the fields of land, infrastructure, transport and tourism within the Declaration to be the World's Most Advanced IT Nation (revised on May 20, 2016) are being promoted in coordination with the IT Strategic Headquarters (Strategic Headquarters for the Promotion of an Advanced Information and Telecommunications Network Society) as headed by the Prime Minister.

1 Promoting ITS

Intelligent Transport Systems (ITS), a system created through the integration of people, roads, and vehicles using the latest Information and Communications Technology (ICT), enables advanced road use, the safety of drivers and pedestrians, the dramatic improvement of transport efficiency and comfort, solves various social problems such as traffic accidents and congestion, environmental and energy problems, and is leading to the creation of new markets in the related fields of the automotive industry, information technology industry, and others.

We are also proactively promoting initiatives pertaining to the collection and distribution of road traffic information which will work effectively for safety measures, congestion measures, and disaster countermeasures in accordance with our aim to realize the world's safest, environmentally friendly, economical road traffic society based on our Declaration to be the World's Most Advanced IT Nation, which was endorsed by the Cabinet in June 2013 and revised in June 2014, June 2015, and May 2016, and on our Public-Private Partnership-Based ITS Concept and Roadmap, which was endorsed by IT Strategic Headquarters in June 2014 and revised in June 2015 and May 2016.

(i) The spread of ITS in society and its effect

a. Promotion of ETC and its effects

Electronic Toll Collection (ETC) is now available on all national expressways, as well as most of the toll roads in Japan. The total number of new setup onboard units is roughly 56.09 million as of November 2016 and its usage rate on all national expressways is roughly 91.0%. Congestion at tollgates, which used to account for roughly 30% of the cause for expressway congestion, has been mostly alleviated and has contributed to reductions in CO_2 emissions and environmental burdens. Additionally, measures utilizing ETC are being implemented, such as the introduction of Smart IC dedicated to ETC interchange and discounts for ETC vehicles. In addition to such toll road uses, it is also possible to use ETC for parking payments and boarding procedures for ferries, showing the spread and diversification of services utilizing ETC.

b. Improvement of providing road traffic information and its effects

Vehicle Information and Communication System (VICS)-compatible onboard units aim to advance travel route guidance and, as of September, 2016, roughly 52.31 million units have been shipped. By providing road traffic information such as travel time, congestion conditions, and traffic restrictions in real-time through VICS, drivers' convenience is improved. This ultimately contributes to better mileage and reduces environmental burdens, including the reduction of CO_2 emissions.

(ii) Technological development and the popularization of new ITS services

a. Popularization and utilizing ETC 2.0

ETC 2.0 onboard units came onto the market in full force in August 2015, and as of November 2016, roughly 1.2 million units had been released. Using ETC 2.0, we are committed to promoting several "smart use of roads" measures. These include provision of support for safe driving through information such as alerts about locations where accidents occur frequently and about objects that have fallen onto the road, introduction of flexible toll rates to reduce congestion and accidents and promotion of highly productive logistics management system, through the use of vehicle speed data, travelled route and travel time data, and other various big data carefully collected from the ETC 2.0 onboard units.

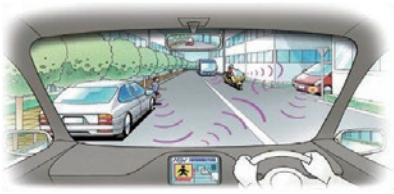
Figure II-10-1-1 ide-area Traffic Congestion Information is Provided by ETC 2.0.

Source) MLIT

b. Promotion of the Advanced Safety Vehicle (ASV) Project

Based on the Advanced Safety Vehicles (ASV) promotion plan, efforts are underway for the development, commercialization, and widespread adoption of Advanced Safety Vehicles (ASV) that assist drivers to drive safely using advanced technology. In FY2016, discussions were held regarding the development of practical ASV technology and other technologies, namely advanced systems that pull vehicles over to the shoulder and take other emergency measures when the driver is driving abnormally.

Figure II-10-1-2 Illustration of a Telecom Use-Type Safe Driving Support System (Advanced Safety Vehicle (ASV))



Source) MLIT

2 Realizing Automatic Driving

Japan has been appointed to jointly chair the Intelligent Transport System and Automatic Driving Informal Working Group (established in November 2014) and the Automatically Commanded Steering Function Informal Working Group (established in February 2015), which were established under the UN World Forum for Harmonization of Vehicle Regulations (WP.29), and is spearheading studies of international safety regulations applicable to automatic driving.

Domestically as well, in the sixth phase of the ASV promotion plan that started in FY2016, we began discussions about specific technical requirements, paying special attention to setting out indicators for development and viability regarding the advanced safety technology required to make autonomous driving a reality. In addition, we engaged in studies on demonstration experiments for the commercialization of communications-based driving support systems in the context of the Cross-ministerial Strategic Innovation Promotion Program (SIP), a collaborative measure undertaken by relevant ministries and agencies, and held a meeting to review the automatic-driving business jointly with the Ministry of Economy, Trade and Industry. We also sorted out the direction that automatic driving should take as we focus on a point 15 years down the road and the issues that must be addressed for the realization of this direction.

Furthermore, in December 2016, we established the MLIT Autonomous Driving Strategy Headquarters, headed by the Minister of the MLIT, and held discussions on the MLIT's policies regarding important matters surrounding autonomous driving, such as motor vehicle technology standards, infrastructure development, and action strategies for logistics and public transportation in hilly and mountainous areas and other regions.

3 Realizing a Society that Utilizes Geospatial Information in an Advanced Manner

We are promoting efforts toward advancing the use and application of geospatial information[Note 1] using ICT and other technologies based on the Basic Plan for the Advancement of the Utilizing of Geospatial Information, which was adopted by a Cabinet decision in March 2017, in pursuit of the realization of a G-Spatial Society (an Advanced Geospatial Information Utilization Society) where anyone can utilize the geospatial information they need anywhere and anytime.

(1) Developing and Updating Geospatial Information as the Foundation of Society

We are coordinating with relevant administrative organizations to promote the rapid development and updating of Fundamental Geospatial Data[Note 2], which can serve as the common basis for positioning on digital maps, and the Digital Japan Basic Map[Note 3], which is a basic map of Japan that includes information required for national land management and other efforts. Various types of information regarding national land are being developed, such as aerial photographs, geographical name information, National Land Numerical Information, continuous monitoring of crustal movements with GNSS-based control stations, and preparation of guidelines for using data obtained from city planning basic surveys to Geographic Information System (GIS). In addition, a system is being constructed that enables prompt assessment and provision of information on national infrastructure, such as development of information on the topographical classification used as the basic material for developing hazard maps prepared for future disasters, and taking aerial photographs urgently during disasters.

(2) Initiatives to Promote the Utilization of Geospatial Information

We are driving forward with efforts to further promote the sharing and mutual use of geospatial information throughout society; our efforts include the launch of G-Spatial Information Center, at which people can uniformly search, obtain and use geospatial information developed by various entities, and the improvement of GSI Maps[Note 4] that facilitate overlaying various geospatial information on the web. In addition, we are promoting the development of a verification project working toward further diffusion to the general public, human resource development, and the realization of a G-Spatial Society, and we collaborated with industry, academia and government to host the Geospatial EXPO 2016 in November 2016.

4 Realizing an Electronic Government

Following the "Declaration to be the World's Most Advanced IT Nation," various initiatives are being carried out to realize an electronic government. In particular, regarding the online usage, initiatives are being taken to improve convenience for citizens as well as making administrative operations simple and efficient, based on the reform policies to improve the convenience of online procedures.

Regarding automobile ownership procedures, a "One-Stop Service (OSS)" that allows for the execution of various procedures, such as inspection, registration, automobile parking space certification, and payment of various vehicle taxes online and at the same time, is being promoted through the cooperation of various ministries. Before this year, the OSS had only been introduced for the new car registration process in 11 prefectures, but in April 2017, we dramatically expanded the target processes and regions. Specifically, nearly all processes required for continuous inspections (vehicle inspections known as "shaken"), registration of moves and other changes, and registration of used cars purchased by a new owner are

Note 1 Information that represents the position of a specific point or area in geospace (including temporal information pertaining to said information) as well as any information associated with this information. Also called G-spatial information (Geospatial Information).

Note 2 Serves as the basis for the position determined for geospatial information on the digital map such as positional information for the geodetic control points, coastlines, boundaries of public facilities, and administrative boundaries. Criteria and standards are defined by ministerial ordinances of MLIT. The Geospatial Information Authority of Japan completed the preliminary development in FY2011, and it is currently being updated along with the Digital Japan Basic Map.

Note 3 Electronically compiled maps that serve as our nation's basic maps instead of the traditional paper maps including the 1:25,000 scale topographic maps. In addition to depicting our national territory appropriately, it serves as the most fundamental information of our national land's conditions with geospatial information developed by the Geospatial Information Authority of Japan.

Note 4 Web maps operated by the Geospatial Information Authority of Japan (https://maps.gsi.go.jp/). More than 1,800 layers of geospatial information have been distributed.

now eligible for OSS, and we are committed to progressively implementing OSS to reduce the burden on prefectural governments by continuing development to integrate national and prefectural systems. In light of government policies such as the Japan Revitalization Strategy and the Declaration to be the World's Most Advanced IT Nation, we intend to continue discussions regarding matters such as measures to further improve convenience using My Number cards.

5 Development and Opening of Optical Fiber for the Management of Public Facilities and Its Housing Space

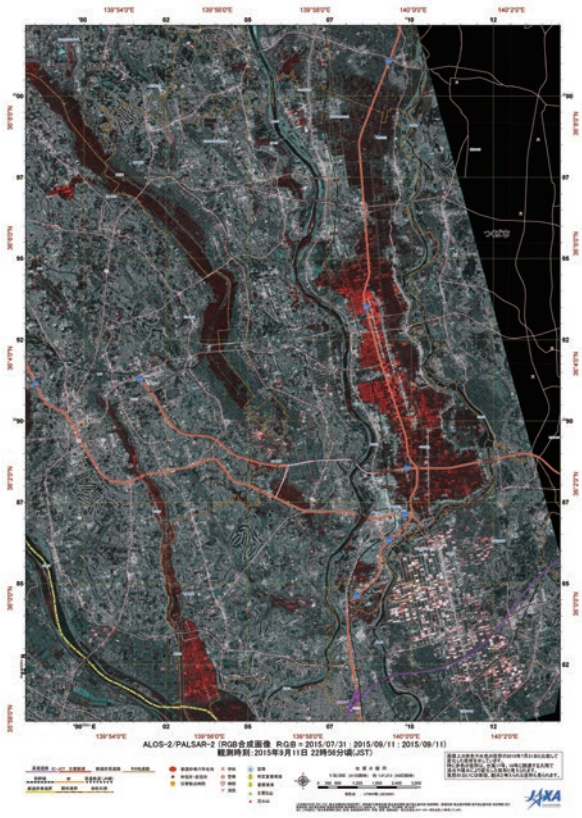
The development and opening of optical fiber for the public facilities management and its housing space is being promoted in rivers, roads, ports, and sewage, as a response to the "e-Japan Priority Policy Program." As of April 2016, the total extent of the optical fiber controlled by the government for river and road management was about 38,000 km, and of this a portion of core cable roughly 18,000 km that does not interfere with the facilities management was opened to private sector business, and in 2017 there were new applications for additional use of about 800 km.

6 Sophisticated Water Management and Water Disaster Prevention Utilizing ICT

In light of the new developments in information technology of recent years, new technology is being applied in the field to further the sophistication of water management and water disaster prevention.

Regarding the monitoring of rivers and their basins, XRAIN (MLIT Functional Radar Rain Gauge Network), a high-resolution, high-frequency system used to accurately and fully understand concentrated heavy rainfall and localized heavy rainfall, is being harnessed for rainfall observations. For the observation of flow amounts and water levels, the introduction and practical application of new technology, such as ADCP (Acoustic Doppler Current Profiler) and image analysis based on the utilization of CCTVs and other types of images, are being promoted. In ascertaining the extent of flooding during a disaster, emergency observations were made (Figure II-10-1-3) with a satellite-based SAR system (Daichi No. 2) during the heavy rains that fell in the Kanto and Tohoku regions in September 2015. The use of big data, including SNS posts and various types of locational data, is being studied.

Figure II-10-1-3 Example of ICT Utilized for Sophisticated Water Management and Flood Prevention



Observational image captured by a SAR system during heavy rains that fell in the Kanto and Tohoku regions in September 2015 (near Joso City, Ibaraki Prefecture).

Source) MLIT

In addition, in pursuit of advancing river management and disaster response, we are promoting efforts to acquire drones equipped with green lasers that can take measurements below water surfaces and to install small, passive water gauges that do not require long-term maintenance.

Also, for sediment-related disasters caused by heavy rains and other factors, unusual conditions are always monitored through such means as a radar rain gauge that can observe the rainfall situation over a large area with a high degree of accuracy, volcano monitoring cameras, and landslide monitoring systems. Additionally, in preparation for the occurrence of a deep-seated catastrophic landslide, the measures that detect the location and scale of such an occurrence at an early stage are being promoted for rapid emergency restoration measures as well as the prevention and mitigation of damage through appropriate warnings and evacuations.

As for the sewage sector, in an effort to reduce flood damage from localized heavy rainfall and the like, we are driving forward with the verification of technology to support the promotion of self-help and mutual aid among regional residents,

and efficient operation through the optimal use of the capacity of existing facilities through the use of water levels inside pipes, rainfall, inundation and other observational data provided by sensors, radars and the like.

7 The Use of Big Data

(1) Support for Formulation of Transportation Plans, etc., Using Big Data

Thanks to a declining population, a dwindling birthrate, and an aging population, the business conditions of route bus businesses, particularly in local regions, are worsening and giving rise to concerns that public transportation networks will shrink and service levels will suffer further. The stabilization of the management of route bus businesses and the restructuring of sustainable local public transportation networks are pressing issues, and management improvements by operators and plans for the reorganization of public transportation by local governments are being studied in many localities.

In light of the circumstances, in FY2016, we used big data and other information derived from the Survey to Support Innovations Benefiting Local Route Bus Businesses with the Use of Big Data, which we implemented in FY2015, to analyze the way that bus companies are managed, and created plans to restructure bus routes and schedules and improve management. In addition, we are providing the Local Route Bus Innovation Business Model Implementation Manual and Data Collection/Analysis Tools, which we developed as measures to support innovations, to the general public and discussing the use of new big data (population flow statistics) toward developing and advancing these tools.

In FY2017, we will implement efforts to develop and advance these Data Collection/Analysis Tools based on the results of these discussions.

(2) Utilization of Automobile Related Information

In order to promote the diffusion of insurance services using telematics based on the Future Vision on the Utilization of Automobile-related Information, which we formulated in January 2015, we hosted seminars for motor carrier businesses at which we shared information about the mechanisms of telematics (installation of onboard equipment, special agreements for insurance premiums, etc.). In addition, we held discussions about specific needs in the selection of information to collect regarding historical information about motor vehicles, and issues surrounding the Act on the Protection of Personal Information toward the realization of traceability services and the like that collect and use historical information about motor vehicles. To continue to strive for the realization of new services, we will discuss the design of systems involving the evaluation of the feasibility of introducing new services and implementation systems for collecting and providing historical information about motor vehicles, and otherwise advance the development of an environment for promoting the utilizing of automobile-related information.

(3) Promotion of Economic Strategies for Local Roads Using IT/Big Data

In an effort to support growth and flexibility and robustly tackle with involving regional economies and societies, we are promoting a new road policy using IT technology and a wide array of big data to the fullest.

Due to the full-scale introduction of ETC 2.0 in August 2015, and the establishment of systems for collecting big data on road transportation speeds and the like, the amount of other transportation, economic and other big data and other information distributed has increased nine-fold over the past nine years. In light of these circumstances, and to resolve regional transportation issues, in December 2015, academic and government entities collaborated to establish institutes in 10 locations in Japan for researching economic strategies for local roads, and have been discussing the implementation of road policies and pilot programs using a wide array of big data, including ETC 2.0, that account for issues in each region.

For example, the local institute in Okinawa, which sees a rapid increase in accidents among foreign rental car drivers, the local institute is planning to use big data from rental cars to identify blackspots for foreigners, and discuss initiatives such as providing alerts through multilingual pamphlets and the like, colored pavement and installing intuitive directional signs that feature pictograms.

(4) New Town Development Using Transportation-related Big Data

In an effort to implement town development that optimizes entire urban areas through the joint efforts of the public and private sectors, we are engaging in development of smart planning, in which we use transportation-related big data to

analyze and fully understand behavior data for elderly people, families raising children and other demographics, conduct simulations to explore how pedestrian behavior changes in relation to changes in the locations of facilities for elderly people, child care and the like, and evaluating the effects of facility location and establishment.

In FY2016, we created models to explain methods of analysis, simulation and other processes based on specific examples, and in the future we will continue to work toward the establishment of open systems that enable all entities, public and private, to use smart planning methods.

Section 2 Promoting the Research and Development of Technology

1 The Position of Technological Research and Development in Technology Policies and Comprehensive Promotion

The Basic Policy on Economic and Fiscal Management and Reform 2016, which was adopted by a Cabinet decision in June 2016, mentions the acceleration of growth strategies as the way toward a 600-trillion-yen economy, and clearly states the need for innovations and other efforts to create a productivity revolution and reimagine the way we work.

The MLIT took into account the government's overall policy, including the Science and Technology Basic Plan, to develop a new MLIT Technology Basic Plan in March 2017 and, adding the perspective of realizing a virtuous cycle in which new technology is autonomously created, to further improve the framework for coordination between industry, academia, and government, as well as the comprehensive promotion of cross-sectoral technological research and development, and is actively adopting the resulting outcomes in public works, the construction and transport industries, and elsewhere.

(1) Initiatives in facilities and Other Organs, Extraordinary Organs, External Bureaus, and National Research and Development Agencies

Key initiatives undertaken by facilities and other organs, extraordinary organs, external bureaus, and national research and development agencies under the jurisdiction of MLIT are as outlined in the figure. National research and development agencies selectively and efficiently conduct research according to social and administrative needs for the purpose of securing maximum results from research and development for the sound growth of our national economy through improvements in the level of science and technology in Japan and other benefits.

Figure II-10-2-1 Major Initiatives for FY2016 by Facility Organizations, Special Organizations, and External Bureaus

Organizations, etc.	Summary
Geospatial Information Authority of Japan	Operating under the auspices of the Geography and Crustal Dynamics Research Center, the Geospatial Information Authority of Japan engages in research and development activities in order to realize a society that utilizes geospatial information in an advanced manner and to contribute to disaster-prevention and environmental objectives by development of a system to monitor slip deficit rate and forward slip on plate boundaries based on wide-area crustal movement data, improvement of orthoimage productivity using full-automated aerial triangulation, technology development for improving time resolution in estimation of crustal deformation using GNSS, and research on aerial detection of temporal development of national land ground deformation through InSAR time series analyses.
Policy Research Institute for Land, Infrastructure, Transport and Tourism	The Policy Research Institute for Land, Infrastructure, Transport and Tourism carries out surveys and research activities: simplified methods of surveying the present state of vacant houses; measures for promoting the employment of high school graduates in the construction industry; analysis of macroeconomic effects of public investment using DSGE models; profitability and efficiency in local public transportation operations; the distribution and selection of visit destinations in Japan by foreign tourists; and organizational safety management methods of transportation companies.
National Institute for Land and Infrastructure Management (NILIM)	The National Institute for Land and Infrastructure Management engages in research on disaster prevention, disaster reduction and risk management that will lead to more efficient evacuations, including a flood danger visualization project, accurate landslide disaster projection using real-time observation and monitoring data, and assurance of safety against storm surge disasters in port and harbor zones; Engages in research on infrastructure maintenance, including methods of diagnosing the health of road structures and designing repairs and reinforcement for them, and technology for conducting maintenance inspections and diagnosing the deterioration of sewage systems; Engages in research and development, including the use of ETC 2.0 to create technology for using roads more effectively, the use of i-Construction to improve construction productivity, and the streamlining of fire prevention and evacuation regulations and the like to promote the use of existing buildings.
Meteorological Research Institute	Conducted research on understanding the phenomena of weather, climate, earthquake volcanoes, and the ocean as well as predictions to contribute to "strengthening measures for typhoons and torrential rains," "strengthening measures for earthquake, volcano, and tsunami disasters," and "strengthening of measures related to climate change and global environment."
Japan Coast Guard	Conducted testing and research for equipment and materials used for Coast Guard duties, testing and research for forensic science at sea, and advancing observation technology for seafloor crustal movements.

Figure II-10-2-2 Key initiatives undertaken by national research and development agencies under the jurisdiction of MLIT in FY 2016

National research and development agency	Summary
Public Works Research Institute*	Conducted research and development to contribute to the realization of a safe, secure society; the strategic maintenance and improvement of social infrastructure; and the realization of a sustainable, active society for the purpose of helping to the efficient creation of quality social infrastructure and the development of Hokkaido.
Building Research Institute*	Conducted research and development on technologies related to housing, buildings and urban planning including developing technology to ensure the structural safety of buildings to contribute to the prevention of damage and destruction due to giant earthquakes and other natural disasters; developing technology to realize the efficient use of resources and energy in harmony with the natural environment in housing, buildings and urban areas to contribute to the reduction of greenhouse gas emissions; and conducted training related to earthquake engineering.
National Traffic Safety and Environment Laboratory	Conducted test research related to the safety assurance of land transport and environment preservation, technical standards conformity assessment of automobiles, and technical evaluations related to recalls, including "Promoting the development and commercialization of next generation heavy vehicles" and "Survey on the requirement for communication between a pedestrian and a vehicle."
National Institute of Maritime, Port and Aviation Technology*	(Cross-Sectoral Research) Conducted cross-sectoral research and development on the issues of promoting the use of seas and strengthening global competitiveness, including research and development regarding sea floor observation and exploration, underwater construction, transportation and communications between offshore platforms and the sea floor, transportation and navigation assistance from land to offshore platforms and other next-generation technologies for surveying marine resources, and research and development regarding the improvement of the safety and maintenance efficiency of runway and other airport infrastructure in terms of enhancing the functions of metropolitan-area airports. (National Maritime Research Institute) Conducted research and development regarding the assurance of safety in maritime transportation, the conservation of the marine environment, marine development and the advancement of marine transportation, including research and development regarding the systematization of pioneering methods of evaluating vessel safety and more efficient safety regulations; research and development regarding innovative technology to contribute to the realization of green innovation for ships, and methods of evaluating operation performance in actual ocean zones; research and development regarding the establishment of fundamental technology and safety evaluation methods for marine renewable energy production systems; and research and development regarding technology to contribute to technical innovations in human resource development that underpin the development of maritime industries. (Port and Airport Research Institute) Conducted research and development regarding the reduction of and recovery from disasters in coastal areas, the formulation of stock to support industry and national life, the preservation of maritime rights and interests and the use and application of the seas, and the formulation and use of aquatic environments, including research and development regarding the reduction of and recovery from earthquake damage; research and development regarding the enhancement of port, harbor and airport functions for ensuring global competitiveness; research and development regarding the development and use of the seas through such efforts as developing ports and harbors on remote islands and securing effective marine energy; and research and development regarding the conservation and use of coastal ecosystems. (Electronic Navigation Research Institute) Conducted research and development that strives to improve safety in air traffic while contributing to the expansion of air-traffic capacity, the improvement of the convenience of air transportation, the improvement of the efficiency of aircraft navigation, and the reduction of the environmental impact of aircraft, including research and development on the advancement of air traffic management through trajectory-based operation; the advancement of airport operations: the optimization of air traffic through the use of onboard information; and the advancement of information sharing and communications between relevant personnel.

*National research and development agency

(2) Initiatives of Regional Development Bureaus

Technical and Engineering Offices as well as Port and Airport Technology Investigation Offices coordinate with relevant offices in their jurisdiction for tests and research of civil works material and water quality, hydraulic tests and design for the effective and efficient development of facilities, development of environmental monitoring systems, and other matters for technology development, as well as the utilization and promotion of new technology tailored to the region.

(3) Promoting Research and Development Technologies of Construction, Traffic and Transportation Fields

Of the important research issues concerning construction technology, issues that are especially urgent and involve a wide range of fields are taken up with the governmental departments taking the lead with the coordination of industry, academia and government to comprehensively and organizationally implement research for the "comprehensive technology development projects" where in FY2016, research and development was conducted for a total of five issues including the "Development of function continuity technology for the disaster site buildings."

Also, for the traffic and transportation fields, technological research and development that contributes to ensuring safety, improving convenience, and protecting the environment are being promoted efficiently and effectively with the coordination of industry, academia and government. In FY2016, we engaged in the development of technology that could be used for upgrading public transportation systems utilizing high-precision positioning technology.

(4) Supporting Private Sector Technological Research and Development

To promote private sector investments in research and development, support is given through preferential tax measures for experimental and research expenses.

(5) Promoting Open-Type Research and Development

In order to promote technological innovation in the construction sector, an open call for the development of technologies to solve policy issues (targeted commercialization in two to three years) was made through the Construction Technology Research and Development Subsidy Program, which invites proposals concerning technological research and development to help upgrade and enhance the international competitiveness of construction technology under the purview of MLIT and further promote research and development carried out by MLIT. In FY2015, four new issues and

eight ongoing issues were adopted.

In addition, in FY2016, three new projects and five ongoing projects were adopted under the Transportation Technology Development Promotion Competitive Funding Program, in which researches and developments were conducted toward the realization of a safe, secure, and comfortable transportation society, the reduction of environmental burdens, and the resolution of other policy issues in the traffic and transportation sectors. And "The first Traffic and Transportation Technology Forum" was held on November 29, 2016, to introduce the current state of researches and developments and present outcomes under the program, and to elicit a wide range of opinions.

2 Promoting the Utilization and Adoption of New Technology for Public Works

(1) New Technology Utilization System for Public Works

In order to actively utilize promising new technology developed by private sector businesses, a "new technology utilization system for public works" that utilizes the New Technology Information System (NETIS) is under operation. Up to now, there were 27 recommended technologies and 60 runner-up recommended technologies chosen as innovative new technologies that will further raise the level of technology concerning public works. Also, to promote efficiency of maintenance and management in the field, for the adoption of new technology in the field and the promotion of further technological development, NETIS is leveraged to set technical themes to use and evaluate the submitted technologies in the field.

(2) Supporting the Utilization of New Technology

In order to promote the utilization of new technology in public works and other areas, utilization is evaluated at every design stage, and technology that provides great utilization benefits are designated by the ordering party when construction is contracted. In addition, we prepare technology comparison charts for every type of construction and theme to serve as references for both orderers and builders in the process of selecting new technologies.

Section 3 Improving Construction Management Technology

1 Improving Costing Technology for Public Works

For the purpose of ensuring the transparency of public works, various price data standards are made public. In FY2015, i-Construction, a method of improving productivity by incorporating ICT into studies, surveys, design functions, construction work, inspections, maintenance functions, and updating processes, was promoted and new estimation standards for ICT construction were enacted.

In addition to the promotion of i-Construction, estimation standards have been revised to facilitate the realization of attractive construction sites made possible by increasing the productivity of all construction site processes through the reinforcement of standards based on the cultivation of the maintenance sector, to be achieved in part by reviewing new bridge preservation work and methods of estimating maintenance work costs, and on amendments to laws on the verification of quality, to be achieved in part by reviewing enhancements to major metropolitan correction functions and the approach to the posting of accounts taken by transportation guidance and security personnel.

In addition, in FY2016, we amended laws and ordinances, revised design standards and made other changes regarding the standard percentages for civil engineering work based on the latest construction conditions.

For construction machinery depreciation costs, field studies were carried out for the construction machinery owned by the contractors.

2 CIM and BIM Initiatives

Construction Information Modeling/Management (CIM) endeavors to seamlessly connect processes at all stages by linking and developing three-dimensional models from the survey, planning, and design stages to the construction and maintenance management stages and promoting the sharing of information among concerned parties involved in the entire project. With trial operations having begun in FY2012, studies on adopting and promoting CIM were carried out in FY2015 in both systemic and technical terms through collaborative efforts on the part of industrial, academic, and governmental players.

Since FY2010, the adoption of Building Information Modeling (BIM) to help visualize design content and integrate and consolidate building information has been subject to trial operations to verify the effect of the adoption of BIM and any issues that might consequently arise. In addition, Guidelines for the BIM models to Create and Use in Government Building Projects, which outline the basic principles and considerations to be taken into account when using BIM for government building projects, were compiled in March 2014. Since FY2014, a track record of cases involving BIM introduction to which the guidelines were applied has been maintained.

Section 4 Technology Development for Construction Machinery and Mechanical Equipment

(1) Development and Supply of Construction Machinery

In order to carry out the appropriate maintenance and management of rivers and roads managed by the national government and respond quickly to disaster recovery, initiatives are being carried out across the nation to implement machinery for maintenance and management, as well as machinery for disaster measures. In FY2016, an extra thirty-eight machines were added and 247 aging machines were updated.

Furthermore, in order to improve efficiency, conservation of labor, and safety of construction associated flood control projects and road development projects, studies as well as research and development for construction machinery and construction processes are being undertaken.

(2) Streamlining and Improving the Reliability of the Maintenance and Management of Machinery

For the protection of citizens' lives and properties from disasters, the construction of floodgate facilities, storage and drainage pump facilities, and road drainage facilities were furthered, starting around late 1965, and many of the facilities are becoming decrepit. As such mechanical equipment is required to function reliably during floods, we are proactively promoting the application of condition-based preventive maintenance in an effort to realize efficient, effective maintenance while ensuring the reliability of facilities.

(3) Utilizing the Accomplishments of Construction Technology Development

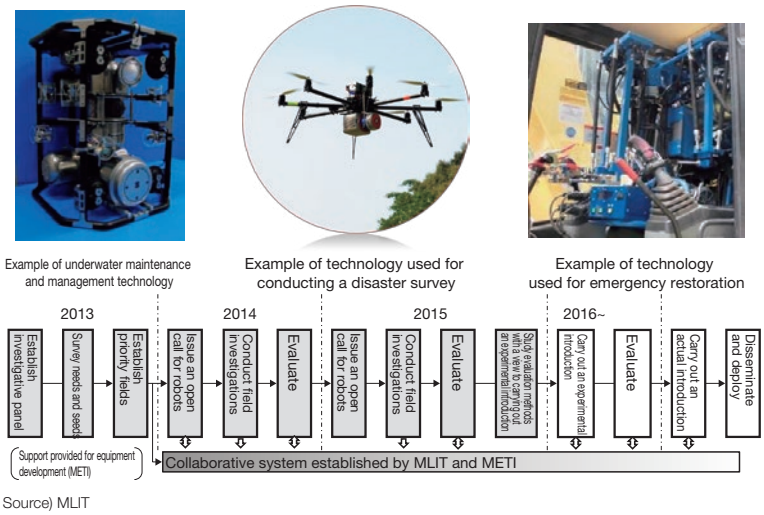
In order to safely and swiftly carry out restoration activity at disaster sites where the danger of secondary disasters such as large-scale floods, sediment-related disasters, and slope collapses are high, a hydraulic shovel that can be remotely controlled, dismantled, and airlifted was developed. It is worth noting that we deployed 11 units in FY2014, and have used them in disaster reconstruction activities, for example sending them to the site of the large-scale slope failure at Aso Ohashi Bridge in Aso Village in the aftermath of the Kumamoto Earthquake in 2016.

(4) Promotion of Development and Introduction of Next Generation Robots for Social Infrastructure

The social infrastructure of Japan is facing problems such as progression of aging, risks of earthquake, storm and flood damage. Therefore, for the "5 important fields" (Maintenance and management: Bridge, Tunnel, and Water; Disaster Response: Investigation and Emergency Restoration) that require the development and introduction of robots, initiatives are underway for the maintenance and management of the social infrastructure and improvement of effect and efficiency during disaster, by planning for the development and introduction of highly practical robots. In FY2014 and FY2015, we made a public appeal to private companies, universities and others for robots capable of addressing our five priority fields, and conducted testing and evaluations at actual sites. Over two years of on-site verifications, we confirmed which technol-

ogies have a specified level of capabilities in the maintenance and management, and since FY2016, have been verifying their practical utility by testing them in environments identical to those in which they will actually be used for inspection.

Figure II-10-4-1 Promotion of Robot Development and Introduction for Next Generation Social Infrastructure



Source) MLIT