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 - Basic Plan for the Advancement of Public and Private Sector Data Utilization (endorsed on June 15, 2018) 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 that will work effectively for safety enhancement, congestion mitigation, and disaster preparedness in accordance with our aim to realize the world's safest, most environmentally friendly and economical road traffic society based on our Declaration to be the World's Most Advanced IT Nation: Basic Plan for the Advancement of Public and Private Sector Data Utilization, which was endorsed by the Cabinet in May 2018, 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, May 2016, May 2017, and June 2018.

(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 62.05 million as of March 2019 and its usage rate on all national expressways is roughly 91.9% as of January 2019. 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 the end of December 2018, roughly 62.20 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 March 2019, roughly 3.71 million units had been set up. Using ETC 2.0, we are making efforts to enhance the provision of information on support for traffic congestion prevention and for safe driving, and are advancing efforts aimed at smooth and safe traffic, utilizing about roadside ETC 2.0 units at 1,700 locations on highways across Japan. We are also promoting efforts for smart road use through pinpoint countermeasures for traffic congestion, countermeasures for traffic accidents, productive and smart logistics management, etc., by utilizing a wide variety of extremely detailed big data, including data on speed, routes used, and sudden braking.

Figure II-10-1-1 Wide-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 FY2017, 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 Autonomous Driving

The Autonomous Driving Strategic Headquarters, led by the Minister of Land, Infrastructure Transport and Tourism, has verified important matters concerning autonomous driving, and published its future initiatives in December 2018, based on the following three perspectives: the development of an environment for realizing autonomous driving, the promotion of the development and dissemination of autonomous driving technology, and demonstration experiments and social implementation aimed at realizing autonomous driving.

Regarding the development of an environment for realizing autonomous driving, Japan has been spearheading discussions as joint chair or vice-chair of the subcommittees involved in the verification of standards for automated driving under the UN World Forum for Harmonization of Vehicle Regulations (WP29). With regard to automated steering, which is a key technology for automated driving, the standards for lane changes entered into effect in October 2018, and we have been earnestly promoting the formulation of international standards, such as by beginning studies on the formulation of standards for lane maintenance while in auto drive mode. Domestically as well, we conducted studies based on the development outline for automated driving formulated in April 2018. We are also working on the necessary system development for the Cabinet decision on the Draft Law to Partially Amend the Road Transport Vehicle Act, and the submission of this to the Diet, based on the Transport Policy Council Report on how to establish the systems required to ensure comprehensive safety from the design and manufacturing process to the running of automated vehicles, compiled in January 2019.

Regarding the development and dissemination of autonomous driving technology, we are making efforts for dissemination, awareness raising, and promotion of introduction for the Safety Support Car (Safety Support Car S), which is equipped with certain functions to support safe driving, including brakes to reduce damage from impact, through efforts such as confirmation by the government that brakes to reduce damage from impact have a certain level of performance, and creation of the Performance Certification System, which publishes the results of these checks, in March 2018. We are also working toward support for autonomous driving through information provision at merge lanes of expressways and toward the enhancement of snow-removal vehicles, for which autonomous driving is being considered.

With respect to demonstration experiments and social implementation aimed at realizing autonomous driving, in addition to conducting demonstrations on public roads of transport services using autonomous driving for the "last mile," we have begun implementing long-term (one to two months) demonstration experiments of automated driving services based at Michi-no-eki (roadside stations) in hilled rural areas, starting in November 2018, as well as demonstration experiments of autonomous driving services in New Towns beginning in February 2019. In addition, we have been implementing demonstrations of (manned) convoy driving toward realizing self-driving truck convoys on the Shin-Tomei Expressway since January 2019.

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 CORSs, and preparation of guidelines for the use and provision of data obtained from city planning basic surveys. 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 promotion of distribution of geospatial information centered on G-Spatial Information Center, which collects and provides various geospatial information developed by each entity, and the improvement of GSI Maps[Note 4] that enables users to overlay various geospatial information on the web. Furthermore, in response to the increased frequency and intensity of natural disasters over recent years, since geospatial information provided through GSI Maps, such as topography, low-lying wetland data from the Meiji era and topographic classification maps, are incredibly useful for ascertaining the risk of natural disasters in each region, we have been conducting dissemination activities of GSI Maps with the objective of increasing the ability to use geospatial information that will lead to the realization of disaster prevention and mitigation. Specifically, we have supported on-site classes and teacher training conducted by the Geospatial Information Authority of Japan's Regional Survey Department, as well as briefings for textbook publishers, a summer school, and other activities. In addition, we are promoting the G-Spatial Project for the use in society of technologies that utilize geospatial information, and have engaged in efforts for further promotion and the cultivation of human resources by holding the Geospatial EXPO 2018 (November 2018) in collaborations among industry, academia, and government.

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 Japan's basic maps instead of the traditional paper maps, including the 1:25,000 scale topographic maps. In addition to depicting Japan's territory appropriately, it serves as the most fundamental information of the nation's land 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/). Centrally delivers the geospatial information for topographic maps, photographs, altitude, terrain classifications, and disaster information developed by the Geospatial Information Authority of Japan.

Column

Airborne Gravity Surveys Make a Drastic Change to Elevation System!

In the Edo era, the Tamagawa-Josui Aqueduct, which installed from current Hamura City, Tokyo to Yotsuya, Shinjuku Ward, flowed through a distance of approximately 43 km with a height difference that was only around 92 m[Note], equal to a gradient of 2 cm per 10 m. In this way, even a little water flows, in accordance with the laws of gravity, from a place where the elevation is high to a place where the elevation is low.

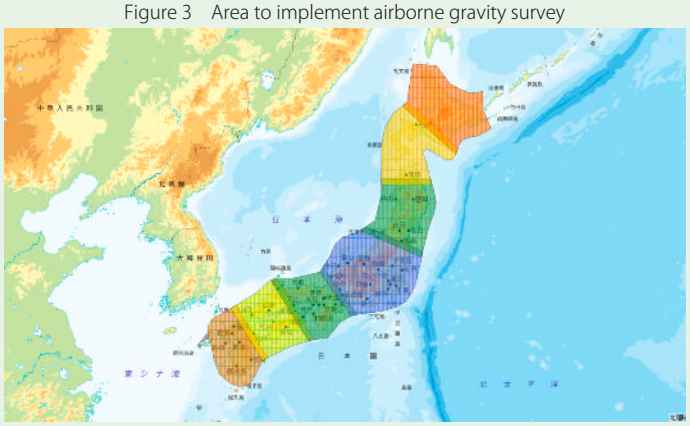
The elevation system in Japan is based on the mean sea level of Tokyo Bay, and has been maintained and managed since the Meiji era through leveling survey performed by the Geospatial Information Authority of Japan by determining elevations of bench marks installed at intervals of approximately 2 km along the main national highways nationwide. However, while leveling is highly accurate, it requires a large amount of time and money, therefore, there are problems with nationwide surveys taking 10 years or longer, and of a certain amount of time being needed to revise the elevations as required for restoration and reconstruction after the occurrence of earthquakes, etc.

Figure 1 Leveling routes in Japan

Figure 2 Leveling (performed by a team of four while walking)

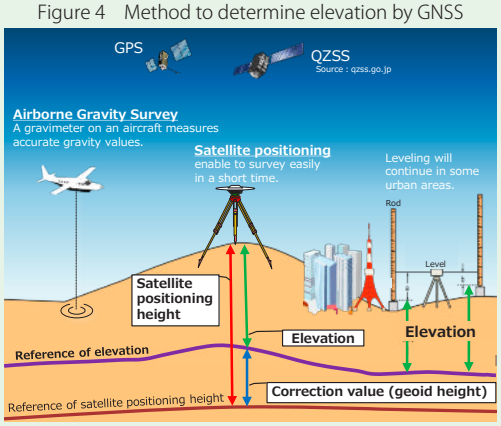
In order to overcome these problems, the Geospatial Information Authority of Japan began efforts in FY2018 to develop an environment for determining elevation by utilizing Global Navigation Satellite Systems (GNSS), such as GPS and Quasi-Zenith Satellite System, in addition to leveling. The key to this is “airborne gravity survey”. In order to determine elevation by GNSS, corrections must be made in consideration of the gravity associated with the flow of water. In airborne gravity surveys, uniform gravity data from across Japan is measured over the course of four years by the use of a gravimeter installed on an aircraft, and correction data (geoid model) is developed for determining elevation by GNSS. With this correction data, anybody can immediately determine the elevation anytime and anywhere, utilizing the features of GNSS, and it is expected that this will lead to the improved efficiency of survey work, which will contribute to prompt restoration and reconstruction after the occurrence of disasters, as well as the creation of new services, such as automated driving and drone delivery, making the best use of highly accurate three-dimensional positioning information including elevation. It should be noted that conventional leveling will continue to be used in areas where sky visibility condition is poor and GNSS does not work, and for applications that require highly precise elevation information. We are aiming to introduce this new elevation system by FY2024.

Figure 3 Area to implement airborne gravity survey



(Implemented by dividing the entire country into some blocks)

Figure 4 Method to determine elevation by GNSS



(Elevation = Satellite positioning height - Correction value)

Note From the website of the Tokyo Waterworks Historical Museum http://www.suidorekishi.jp/images/about/s_history/s_history_3.pdf

4 Realizing an Electronic Government

We are making efforts toward realizing an electronic government, based on our Declaration to be the World's Most Advanced Digital Nation: Basic Plan for the Advancement of Public and Private Sector Data Utilization. In particular, with regard to policies aimed at improving the convenience of citizens and businesses through digitization across the whole government - both national and regional - and other policies aimed at increasing convenience for citizens and businesses, we are actively promoting efforts that the government as a whole should take, based on the Implementation Plan for Digital Government (endorsed at an e-Government ministerial meeting on January 16, 2018). In addition, the MLIT formulated the MLIT Digital Government Medium- to Long-Term Plan (June 2018), and has been strongly promoting initiatives.

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. We began a service for the new registration procedures for new vehicles in 2005, and in April 2017, we expanded the scope of these procedures to include continuous inspections, changes to registration, and registrations of transfers, etc., and also expanded the subject regions for the registration of new vehicles to 38 prefectures.

In addition, at Future Investment Strategy 2018, in order to enhance and expand the conversion to a one-stop process for the various procedures related to car ownership, we promoted the digitization of automobile inspection certificates, established the Working Group on the Digitization of Automobile Inspection Certificates in September 2018, and conducted studies toward the digitization of vehicle inspection certificates in order to eliminate the need to visit a transportation office in order to receive the vehicle inspection certificate required to file an online application for an ongoing inspection, etc.; we published an interim report on this in January 2019. We will continue to promote the digitization of automobile inspection certificates based on this interim report.

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 March 2018, 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 applications for additional use have been received.

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 river flooding and river basins, XRAIN (eXtended RAdar Information Network), a high-resolution, high-frequency system used to accurately and in real time understand concentrated heavy rainfall and localized heavy rainfall, is being harnessed for rainfall observation, and its distribution area is being gradually extended across Japan. In addition, we are promoting the technical development of low-cost crisis management-type water level meters that specialize in conducting measurements at the time of flooding; the installation of simple river monitoring cameras that wirelessly transmit still images; and unmanned, labor-saving flow rate monitoring equipment, through the use of the latest IoT and ICT technology.

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.

To ascertain the inundation range and sediment landslide disaster areas at the time of a disaster, we are promoting initiatives to make emergency observations through the SAR satellite (Daichi 2), based on the Agreement to Cooperate in Provision of Disaster Information Using Satellites, concluded between the Ministry of Land, Infrastructure and Transport and JAXA in May 2017.

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 Promoting Open Data

Efforts to address open data are being actively promoted within the national government and local public entities, as part of developing environment aimed at utilizing public and private sector data as stated in the Declaration to be the World's Most Advanced Digital Nation - Basic Plan for the Advancement of Public and Private Sector Data Utilization. One of those efforts is to have discussions toward making the data held by the Ministry of Land, Infrastructure, Transport and Tourism open data, while ascertaining in detail the needs of private enterprises, through the Public-Private Round-tables on Open Data (an opportunity for direct discussion between enterprises in the private sector wishing to utilize data and administrative institutions that hold data), hosted by the Cabinet Secretariat from January 2018.

Under these circumstances, regarding data held by public transportation business operators, we set up the Review Meeting for Promoting Open Data in the Field of Public Transportation in March 2017, with the aim of creating opportunities to promote open data in that field. Interested parties from the public and private sectors participated and discussed relevant issues, and an interim report was released in May 2017. Since FY2018, we have been working on public-private verifications and experiments on the provision of information through the use of open data, in order to enhance the provision of operating information, etc., at public transport organizations based on 1) demonstration experiments through public-private sector coordination, 2) discussions about transforming operation status information (positioning information, etc.) and information that would help people with limited mobility to travel into open data, and 3) promoting open data in local regions.

8 The Use of Big Data

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

In an effort to support growth and flexibility and robustly promote progress on issues involving regional economies and societies, we are promoting a new road policy that uses and applies ICT technology and 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 are promoting discussions about 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, in order to prevent traffic accidents involving rental cars driven by foreign tourists, the number of which is rapidly increasing, efforts are being implemented for pinpoint accident countermeasures, including the designation of characteristically dangerous spots for foreign tourists by utilizing data on sudden braking recorded by ETC 2.0 in rental cars departing from areas around airports used often by foreign tourists, and installing multi-language signs calling for attention and providing warnings in multi-language pamphlets.

In addition, sharing data owned both by the public and by the private sectors has been promoted by applying a wide range of measures.

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

We are advancing the development of smart planning, which is a planning method for considering facilities distribution, formation of spaces, and transport policies through simulation of the movement of people and estimation of the effects of policy implementation based on activity data at the individual level extracted from transport-related big data.

In FY2018, we endeavored to make improvements in sophisticated systems through verification in multiple cities, and to enhance performance indicators and measures that can be evaluated. In the Guidebook for Practicing Smart Planning [Second Edition], published in September 2018, we made improvements to the models presented in the first edition, added case studies, and added a glossary. We are also making efforts to disseminate analysis methods, including working with the Smart Planning Research Subcommittee, set up under the Japan Society for Civil Engineers, to host a seminar targeted at business, government, and academic practitioners for the acquisition of the skills required in order to propose Smart Planning survey plans.

(3) Revision of Topographic Maps Through the Use of Big Data

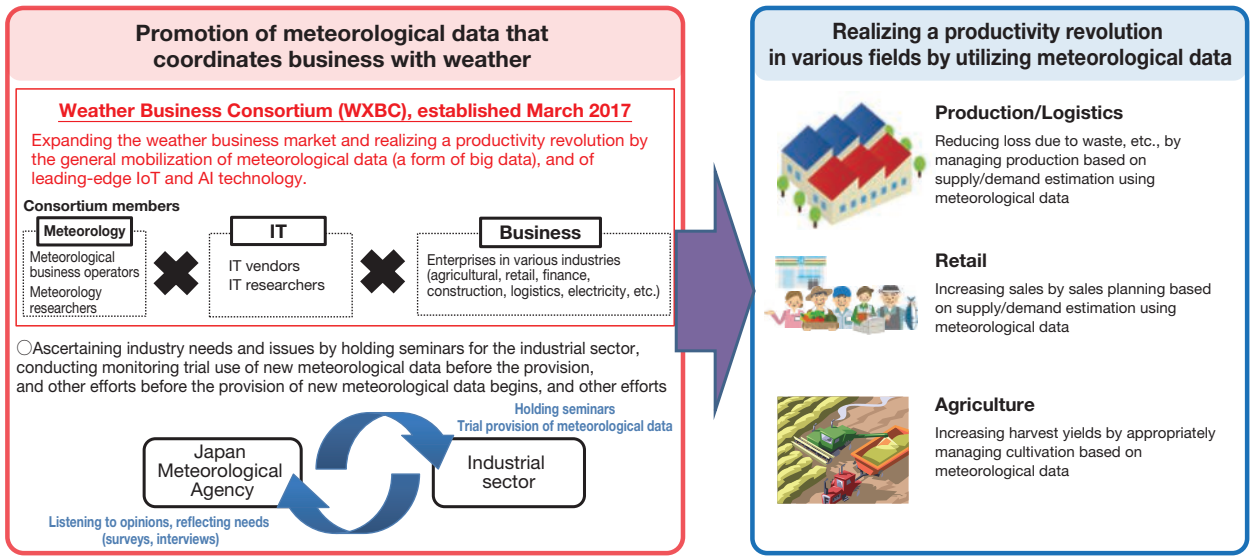
Topographic maps are used by mountaineers and hikers as the basic maps of national land, and are also used as the basis for various maps. In order to display mountain paths in these topographic maps more accurately, we are promoting efforts to correct topographic maps through the use of route information obtained by mountain climbers through the use of smartphones (big data). In FY2018, we revised the mountain trails of popular mountains across Japan through the use of big data provided under cooperation agreements with private business operators.

9 Efforts for Increasing Productivity in Business Utilizing Meteorological Data

By combining ICT technologies, in which IoT and AI have rapidly developed, with meteorological data (a form of big data), increases in work efficiency and sales, and improvements in safety are expected in a wide range of industries, including agriculture, retail, transportation, and tourism. Therefore, the Japan Meteorological Agency has been ascertaining the industrial sector's needs and related issues through the Weather Business Consortium (WXBC; established in March 2017), an industry-academia-government collaboration, and has been promoting the utilization of meteorological data by providing new meteorological data in response to those needs.

The specific results of these efforts include advances in the utilization of observation data from the Himawari 8 weather satellite and solar radiation estimation data. For example, a demonstration experiment of efficient harvesting of dry, high-quality pasturage made possible by the very detailed water vapor forecast is planned to be held in Hokkaido in FY2019.

Figure II-10-1-3 Increasing Productivity in Various Fields by Promoting Meteorological Data Utilization



Source) Japan Meteorological Agency

10 Promotion of Smart Cities

In August 2018, we incorporated new technologies, such as AI and IoT, and public-private big data into town development, and with the objective of further promoting efforts related to smart cities that aim to solve problems facing urban areas, created and published For the Realization of Smart Cities [Interim Report].

In addition, in that same month, toward the realization of Society 5.0-era smart cities, we confirmed an intent for ongoing partnership and cooperation with the Japan Business Federation. With the cooperation of the JBF, from December 2018 to January 2019 we solicited proposals from companies and local governments for seeds (technology), needs, and town planning ideas for the realization of smart cities; we received 398 technical proposals from 146 organizations, as well as 271 needs proposals from 61 organizations.

Based on the results of these proposals, and for the implementation of a model project in FY2019, we began public bidding for model projects in March 2019, and will select the winning bidders in May.

Furthermore, in the period from October 2018 to February 2019, we conducted demonstration experiments on the topic of health in Sapporo, Hokkaido, and on the topic of bustle in Toshima-ku, Tokyo.

Section 2 Promoting Technological Research and Development

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

In light of the policies of the government as a whole, including the Science and Technology Basic Plan (adapted by a Cabinet decision on January 22, 2016), the MLIT developed the Fourth MLIT Technology Basic Plan in March 2017. This policy has conveyed the direction of the MLIT's policies on technology, and through this, promotes technology research and development with efficient and effective collaboration among business, academia, and government, the results of which will be actively reflected in public utilities and the construction and transportation industries, etc. In addition, as part of the follow-up to this plan, in FY2018 we established the Roundtable for the Basic Policy of the National Land Transportation Technology Administration under the MLIT Panel on Infrastructure Development and Traffic Policy Council Technology Committee, at which the direction of future technology policy is discussed.

(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 Main initiatives during FY2018 at institutions, special institutions, and overseas bureaus

Organizations, etc.	Content
Geospatial Information Authority of Japan	At the Geography & Crustal Dynamics Research Center, research and development has been conducted to contribute to the realization of an advanced geospatial information society, as well as disaster prevention and the environment through activities including Research on the Surface Detection of Temporal Changes of National Land Deformation through Interferometric SAR Time Series Analysis, Research on the Construction of a Height Reference System Based on Precise Gravity Geoids, Research on Crustal Deformation Analysis in Consideration of Topography and Underground Structure, Research on the Construction of a Prompt and Highly Precise GNSS Steady State Analysis System, Research on Real Time Inundation Monitoring, and Research on Automatic Feature Extraction through the Use of AI, etc.
Policy Research Institute for Land, Infrastructure, Transport and Tourism	Investigations and research have been conducted in areas including Life Support for Contributing to Aging in Place, the Effective Maintenance and Management of Regional Infrastructure through Area Management, the Functional Integration of Urban Life Services through the Effective Use of Sponged Urban Spaces, Methods for Verifying Local Public Transport Maintenance Measures, Sustainable Tourism Policy, Seamless Mobility as a Service (MaaS) using the Mobility Cloud, and the Organizational Safety Management of Transportation Companies, etc.
National Institute for Land and Infrastructure Management (NILIM)	Promoting research for the building of a safer, more secure, energetic, and attractive society, with an emphasis on four research areas: research on disaster prevention, disaster mitigation, and crisis management, including the Flood Risk Visualization Project, the Prompt Ascertaining of Large-scale Sediment Disaster through the Use of Remote Sensor Technology, and the Ascertaining of Surge Risk through the Use of Technology to Forecast Waves and Tide Levels, research relating to the maintenance and management of infrastructure, including Technical Development and Revision of Inspection Procedures Towards a Road and Structure Maintenance Second Stage, and the Realization of the Accurate Maintenance and Management of Airport Civil Engineering Facilities, research on productivity revolution, including the Improvement of Efficiency through the Use of 3D Models, Etc., and Support for the Realization of Automated Driving, and research for regional revitalization and the improvement of living conditions, such as the Appropriate Management of Vacate Houses Based on Local Conditions.
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 conducted researches to improve the seafloor geodetic observation technique.

Figure II-10-2-2 Key initiatives undertaken by national research and development agencies under the jurisdiction of MLIT in FY2018

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 of air traffic while contributing to the air traffic expansion, the improvement of the convenience of air traffic, the improvement of the efficiency of aircraft operations, and the reduction of the aircraft environmental effects, including the enhancement of air traffic management by trajectory based operations; the enhancement of airport operations: the optimization of air traffic using on-board information; and the enhancement of information sharing and communication systems.

*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 FY2018, research and development was conducted for a total of six issues, including Research on the Advancement of Construction Production Systems Through the Utilization of AI. 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 FY2018, we engaged in the development of technology that could be used for auto berthing and un-berthing systems utilizing high-precision positioning technology.

(4) Supporting Private Sector Technological Research and Development

To promote private sector investments in research and development, we established a tax credit system for testing 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 FY2018, five new issues and seventeen ongoing issues were adopted.

In addition, in FY2018, two 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 "Traffic and Transportation Technology Forum" was held on October 17, 2018, 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. In FY2018, one recommended technology and six runner-up recommended technologies were introduced as groundbreaking new technologies to further increase the level of technology related to public works, etc. In addition, we are promoting the introduction of new technologies to sites, as well as further technical development by setting technical topics based on site need, and by utilizing and evaluating the applied technologies on site.

(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 is designated by the ordering party when construction is contracted. In addition, we prepare and publish 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, with the objective of promoting the utilization of new technologies.

Section 3 Improving Construction Management Technology

1 Improving Costing Technology for Public Works

For the purpose of promoting ensured quality in public works, and in order to accurately establish price estimates from the viewpoint of appropriately reflecting the mid- to long-term fostering and securing of workers and market conditions, efforts have been made to consider quantity survey standards and implement revisions when necessary.

Regarding public civil works, efforts have been made to make all construction processes fully appropriate. Such efforts include the revision of the Quantity Surveying Criteria for Civil Works Utilizing ICT, based on policies stated in the Expansion of Comprehensive ICT Utilization in i-Construction, for the purpose of promoting i-Construction, which is aimed at attractive construction sites, as well as the active implementation of works comprehensively utilizing ICT, including works for SMEs.

In addition, the overall quantity survey standards have been revised, in light of the latest status of enforcement and regional characteristics, by revising laws and design criteria and accurately reflecting labor, resource, and transaction costs in social economic trends and markets.

2 BIM and CIM Initiatives

Building / Construction Information Modeling/Management (BIM/CIM) endeavors to seamlessly connect processes at all stages of construction by linking and developing three-dimensional models from the survey, planning, and design stages to the construction and maintenance management stages and by promoting the sharing of information among concerned parties involved in the entire project. With trial operations having begun in FY2012, along with progress made in discussions toward the introduction and promotion of CIM from the perspectives of both system and technology through industry-academia-government coordination, the Guidelines to CIM Introduction (tentative name) was formulated in FY2016. The guidelines include information on making BIM/CIM models, utilization methods, etc., and also addresses the role played by BIM/CIM businesses that place orders with related parties coordinating widely with public utilities, and fundamental work methods and points for consideration. In March 2018, we expanded the (draft version) of the guidelines, formulated the 3D Model Notation Standard (tentative name) to prescribe the notation method in the case of 3D models being used as contract drawings, and aimed to expand the utilization of BIM/CIM by making the application of BIM/CIM standard in detailed design documents for large structures, etc.

In FY2010 to FY2012, the adoption of Building Information Modeling (BIM) for government building projects to help visualize design content and integrate and consolidate building information was made subject to trial operations to verify the effect of the adoption of BIM and any issues that might consequently arise. Guidelines for Development and Use of BIM Models for Government Buildings Projects, which indicates the basic concepts and points to note in the creation of BIM models, were created in March 2014 based on the results of this. The guidelines were revised in August 2018 so as to make BIM easier to use in the construction stage, and further utilization of BIM is being planned.

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 FY2018, an extra twenty-nine machines were added and 267 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 and 11 units were deployed in FY2014. In FY2018, this was used in disaster recovery activities, including the dispatch to Kuramato-cho, Nakatsu City, Oita Prefecture, where four houses were damages by landslide.

(4) Introduction of AI, Robotics, and Other Innovative Technologies to the Infrastructure Sector

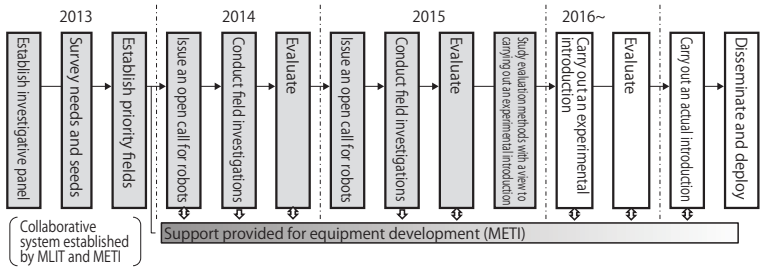
The social infrastructure of Japan is facing problems such as progression of aging, and the risk of earthquakes, storms and flood damage. Therefore, for the five important fields (Maintenance and management: Bridge, Tunnel, and Water; Disaster Response: Investigation and Emergency Restoration) that require the development and introduction of robots, we have engaged in initiatives 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. In the maintenance and management sector, we are trialing through actual inspection technologies that have been confirmed to reach a certain performance over the course of two-year site verifications. In the future, in addition to supporting "Human Work", support for "Human Judgment" will be key for improving productivity, and we will promote the implementation in society of artificial intelligence (AI) in the construction production process, maintenance and management, and disaster response sectors. For this, we will provide Teaching Data, consisting of the correct decisions of civil engineers that have been accumulated, will promote the development of private AI, and will develop an environment in which the results of technical developments can be used.

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

Example of underwater maintenance and management technology

Example of technology used for conducting a disaster survey

Example of technology used for emergency restoration



Source) MLIT